FORM PTO-1520 (8-83)

REEXAMINATION

6181990

CONTROL NUMBER	CERTIFICATE DATE	CERTIFICATE NUMBER
90/006742		

CLASS	SUBCLASS	[redacted] CRU	ART UNIT	EXAMINER
701	014	SCANNED ______ Q.A. ______	3661	

TITLE OF INVENTION (FOR DESIGN APPLICATION ONLY):

TERMINAL DISCLAIMER	☐ The term of this patent subsequent to ______ (date) has been disclaimed.	☐ The term of this patent shall not extend beyond the expiration date of Pat. No. ______.	☐ The terminal ______ months of this patent have been disclaimed.

ISSUING CLASSIFICATION

ORIGINAL		CROSS REFERENCE(S)						
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					
INTERNATIONAL CLASSIFICATION								
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/								
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/								

☐ Continued on Issue Slip Inside File Jacket

Form PTO-2009 (Rev. 4-97)

WARNING: The information disclosed herein may be restricted. Unauthorized disclosure may be prohibited by the United States Code Title 35, Sections 122, 181 and 368. Possession outside the U.S. Patent & Trademark Office is restricted to authorized employees and contractors only.

REQUESTER'S CORRESPONDENCE ADDRESS ☐ PATENT OWNER ☐ THIRD PARTY ☒

Christopher F. Regan *
Allen Dyer Doppelt Milbrath &
Gilchrist, P.A.
255 S. Orange Avenue
Post Office Box 3791, Orlando, FL 32802
(Cust. No. 27975)

COPENDING OFFICE PROCEEDINGS		PREPARED FOR CERTIFICATE
TYPE OF PROCEEDING	NUMBER	
		(Docket Clerk)
		REEXAMINED AND PASSED FOR CERTIFICATE

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United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
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Alexandria, Virginia 22313-1450
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Bib Data Sheet

CONFIRMATION NO. 1151

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
90/006,742	08/12/2003 RULE	701	3661	GCSD-1360 (51298)

APPLICANTS

6181990, Residence Not Provided;
Teledyne Technologies, Inc.(Owner), Los Angeles, CA;
Harris Corporation(3rd Pty. Req.), Melbourne, FL;

** CONTINUING DATA ************************* VS (?)

This application is a REX of 09/126,156 07/30/1998 PAT 6,181,990

** FOREIGN APPLICATIONS ******************** None (?)

Foreign Priority claimed / 35 USC 119 (a-d) conditions met / Verified and Acknowledged	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed ☐ yes ☑ no 35 USC 119 (a-d) conditions met ☐ yes ☑ no ☐ Met after Allowance Verified and Acknowledged ____ Examiner's Signature ____ Initials			33	8

ADDRESS

Kirkpatrick & Lockhart LLP
Henry W. Oliver Building
535 Smithfield Street
Pittsburgh ,PA 15222

TITLE

AIRCRAFT FLIGHT DATA ACQUISITION AND TRANSMISSION SYSTEM

FILING FEE RECEIVED		
2520	FEES: Authority has been given in Paper No. ________ to charge/credit DEPOSIT ACCOUNT No. ________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ________ ☐ Credit

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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90/006,742	08/12/2003 RULE	701	3661	GCSD-1360 (51298)

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6181990, Residence Not Provided;
Teledyne Technologies, Inc.(Owner), Los Angeles, CA;
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** CONTINUING DATA *************************

This application is a REX of 09/126,156 07/30/1998 PAT 6,181,990

** FOREIGN APPLICATIONS ********************

Foreign Priority claimed ☐ yes ☐ no 35 USC 119 (a-d) conditions met ☐ yes ☐ no ☐ Met after Allowance Verified and Acknowledged ______ Examiner's Signature ______ Initials	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
			33	8

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AIRCRAFT FLIGHT DATA ACQUISITION AND TRANSMISSION SYSTEM

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90/006742

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PATENT APPLICATION

90006742

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2	Title Report	9/3/03
3	Notice of Reexam Req. Fil. Dt.	9/12/03
4	Assigned Grp.	9/12/03
5		1-10-03

US006181990C1

(12) **EX PARTE REEXAMINATION CERTIFICATE** (5393rd)

United States Patent (10) Number: **US 6,181,990 C1**

Grabowsky et al. (45) Certificate Issued: **Jun. 6, 2006**

(54) **AIRCRAFT FLIGHT DATA ACQUISITION AND TRANSMISSION SYSTEM**

(75) Inventors: John Francis Grabowsky, Camarillo, CA (US); David Ray Stevens, Simi Valley, CA (US)

(73) Assignee: Teledyne Technologies Incorporated, Los Angeles, CA (US)

Reexamination Request:
No. 90/006,742, Aug. 12, 2003

Reexamination Certificate for:

Patent No.:	6,181,990
Issued:	Jan. 30, 2001
Appl. No.:	09/126,156
Filed:	Jul. 30, 1998

(51) Int. Cl.
H04B 7/00 (2006.01)
G06F 13/00 (2006.01)

(52) U.S. Cl. .... 701/14; 701/35; 701/16; 455/431; 342/33; 73/178 T

(58) Field of Classification Search .... 701/3, 701/14, 16; 340/945, 947, 948, 951, 960; 73/178 T; 342/33
See application file for complete search history.

(56) **References Cited**

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6,308,045	B1	10/2001	Wright et al.	455/66

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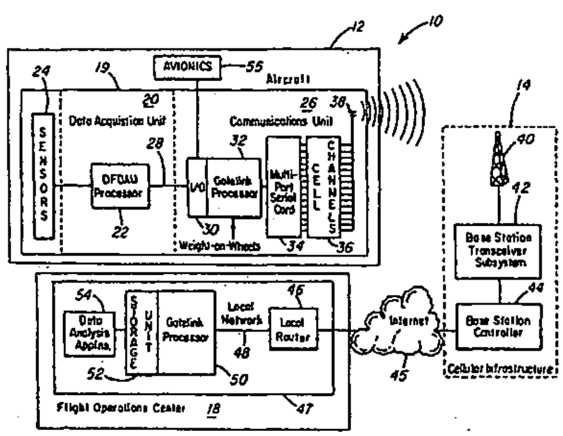
OTHER PUBLICATIONS

Airlines Electronic Engineering Committee, ARINC Characteristic 751, "Gate-Aircraft Terminal Environment Link (Gatelink)-Aircraft Side", Published Jan. 1, 1994.
Airlines Electronic Engineering Committee, Specification 632, "Gate-Aircraft Terminal Environment Link (Gatelink)-Ground Side", Published Dec. 30, 1994.

Primary Examiner—Y. Beaulieu

(57) **ABSTRACT**

An aircraft data transmission system used with an aircraft having a data acquisition unit. The system includes a communications unit located in the aircraft and in communication with the data acquisition unit. The system also includes a cellular infrastructure in communication with the data communications unit after the aircraft has landed. The system further includes a data reception unit in communication with the cellular infrastructure.



EX PARTE REEXAMINATION CERTIFICATE ISSUED UNDER 35 U.S.C. 307

THE PATENT IS HEREBY AMENDED AS INDICATED BELOW.

Matter enclosed in heavy brackets [ ] appeared in the patent, but has been deleted and is no longer a part of the patent; matter printed in italics indicates additions made to the patent.

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

The patentability of claims 8–14 and 25–32 is confirmed.

Claims 1, 15, 18, 19 and 33 are determined to be patentable as amended.

Claims 2–7, 16, 17 and 20–24, dependent on an amended claim, are determined to be patentable.

New claims 34–51 are added and determined to be patentable.

1. An aircraft data transmission system, the aircraft having a data acquisition unit, *and the aircraft including a data storage medium having stored thereon flight data gathered in-flight by at least a first sensor on the aircraft*, comprising:

a communications unit located in the aircraft and in communication with the data acquisition unit;

at least a second sensor configured to sense a landing of the aircraft;

a cellular infrastructure in communication with said communications unit after the aircraft has landed, *wherein the cellular infrastructure communicates said flight data, and* wherein the communication is initiated [automatically upon] *when at least the second sensor senses the* landing of the aircraft; [and]

a data reception unit in communication with said cellular infrastructure*; and*

wherein said flight data includes time, airspeed, altitude, vertical acceleration, and heading data relating to a flight of the aircraft.

15. An aircraft data transmission system, the aircraft having a data acquisition unit, *the aircraft including a data storage medium having stored thereon flight data gathered in-flight by at least one sensor on the aircraft*, comprising:

sensing means for sensing a landing of the aircraft;

means for transmitting *said flight* data from the data acquisition unit, via a cellular infrastructure after the aircraft has landed, wherein transmission of the data is initiated [automatically upon] *when the sensing means sense the* landing of the aircraft; [and]

means for receiving said *flight* data from said cellular infrastructure*; and*

wherein said flight data includes time, airspeed, altitude, vertical acceleration, and heading data relating to a flight of the aircraft.

18. A method of transmitting aircraft flight data from an aircraft, comprising:

receiving flight data from a data acquisition unit;

receiving a signal indicating a landing of the aircraft from at least a first sensor;

transmitting said flight data via a cellular communications infrastructure after the aircraft has landed, wherein the cellular communications infrastructure is accessed [automatically upon landing of the aircraft] *in response to the signal*; [and]

receiving said transmitted flight data*; and*

wherein said flight data is gathered in-flight by at least a second sensor on the aircraft, and includes time, airspeed, altitude, vertical acceleration, and heading data relating to a flight of the aircraft.

19. A computer-implemented method of transmitting aircraft flight data from an aircraft, comprising:

receiving flight data from a digital flight data acquisition unit, *wherein said flight data is gathered in-flight by at least a first sensor on the aircraft, and includes time, airspeed, altitude, vertical acceleration, and heading data relating to a flight of the aircraft;*

receiving a signal indicating a landing of the aircraft from at least a second sensor;

processing said flight data to prepare said data for transmission; and

transmitting said processed data via a cellular infrastructure after the aircraft has landed, wherein the cellular infrastructure is accessed [automatically upon landing of the aircraft] *in response to the signal.*

33. A computer readable medium having stored thereon instructions which when executed by a processor, cause the processor to perform the steps of:

receiving flight data from a digital flight data acquisition unit in an aircraft, *wherein said flight data is gathered in-flight by at least a first sensor on the aircraft, and includes time, airspeed, altitude, vertical acceleration, and heading data relating to a flight of the aircraft;*

receiving a signal indicating a landing of the aircraft from at least a second sensor;

processing said flight data to prepare said data for transmission; and

transmitting said processed data via a cellular infrastructure when said aircraft has landed, wherein the cellular infrastructure is accessed [automatically upon landing of the aircraft] *in response to the signal.*

34. The system of claim 1, wherein the cellular infrastructure is a cellular telephone infrastructure.

35. The system of claim 34, wherein said data reception unit is in communication with said cellular infrastructure via the Internet.

36. The system of claim 34, wherein said data reception unit is in communication with said cellular infrastructure via the public switch telephone network.

37. The system of claim 34, wherein said data communications unit has at least one modem in communication with said cellular infrastructure and said data reception unit has at least one modem in communication with said cellular infrastructure.

38. The system of claim 34, wherein said communications unit includes:

a processor;

a serial card in communication with said processor;

at least one cell channel in communication with said serial card; and

at least one antenna in communication with said cell channel.

39. The system of claim 34, wherein said cellular infrastructure includes:

an antenna;

a transceiver subsystem in communication with said antenna; and

a controller in communication with said transceiver subsystem.

40. The system of claim 34, wherein said data reception unit includes:

a router; and

a processor in communication with said router, said processor having a storage unit.

41. The system of claim 15, wherein the cellular infrastructure is a cellular telephone infrastructure.

42. The system of claim 41, wherein said means for transmitting data includes a processor.

43. The system of claim 41, wherein said means for receiving data includes a processor.

44. The method of claim 18, wherein the cellular communications infrastructure is a cellular telephone infrastructure.

45. The method of claim 19, wherein the cellular infrastructure is a cellular telephone infrastructure.

46. The method of claim 45 further comprising receiving said transmitted data at a flight operations center.

47. The method of claim 46 further comprising receiving said transmitted data and transmitting said received data via the Internet before receiving said transmitted data at a flight operations center.

48. The method of claim 46 further comprising receiving said transmitted data and transmitting said received data via the public-switched telephone network before receiving said transmitted data at a flight operations center.

49. The method of claim 45 wherein processing said flight data includes:

compressing said flight data;

encrypting said flight data;

segmenting said flight data; and

constructing packets of data from said segmented flight data.

50. The method of claim 45 wherein receiving said transmitted data includes:

acknowledging receipt of said transmitted data;

reassembling said received data;

decrypting said reassembled data;

uncompressing said decrypted data; and

storing said uncompressed data.

51. The method of claim 33, wherein the cellular infrastructure is a cellular telephone infrastructure.

* * * * *

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I HEREBY CERTIFY THIS PAPER OR FEE IS BEING DEPOSITED WITH THE U.S. POSTAL SERVICE "EXPRESS MAIL POST OFFICE TO ADDRESSEE" SERVICE UNDER 37 CFR 1.10 ON THE DATE INDICATED BELOW AND IS ADDRESSED TO: MAIL STOP EX PARTE REEXAM, COMMISSIONER FOR PATENTS, P. O. BOX 1450, ALEXANDRIA, VA 22313-1450.

EXPRESS MAIL NO: EV 322683106 US

DATE OF DEPOSIT: August 12, 2003

NAME: Justin Gorea

SIGNATURE: Justin Gorea

REQUEST FOR REEXAMINATION OF
U.S. PATENT NO. 6,181,990

ATTORNEY DOCKET NO. GCSD-1360 (51298)

REQUEST FOR REEXAMINATION TRANSMITTAL FORM

Sir:

1. This is a request for reexamination pursuant to 37 CFR 1.510 of U.S. Patent No. 6,181,990, issued January 30, 2001 to Grabowsky et al. The request is made by a third party requestor.

2. The name and address of the person requesting reexamination is: Harris Corporation, 1025 West NASA Blvd., Mail Stop A-21, Melbourne, Florida 32919.

08/13/2003 SMINAS 00000003 010378 90006742
01 FC:1812 2520.00 DA

Exhibit C - Part 1
Page 60

TDY0001992

REQUEST FOR REEXAMINATION OF U.S. PATENT NO. 6,181,990

3(a) Authorization is hereby given to charge the fee of **$2,520.00** to Harris Corporation Deposit Account No. **08-0870** regarding the reexamination fee, 37 CFR 1.20(c)(1);

3(b) The Commissioner is hereby authorized to charge any delinquency of the fee as set forth in 37 CFR 1.20(c) to Deposit Account No. **08-0870**.

4. Any refund should be credited to Deposit Account No. **08-0870** (37 CFR 1.26(c)).

5. A cut-up copy of the patent to be reexamined with a single column of the printed patent securely mounted on one side of a separate paper or a permanent reproduction thereof is enclosed (37 CFR 1.510(b)(4)).

6. There is no CD-ROM, CD-R, computer program (appendix) or large table.

7. There is no nucleotide and/or amino acid sequence submission.

8. There are no known disclaimers, certificates of correction or reexamination certificates issued in this patent.

9. Reexamination of Claims 1-4, 6, 7, 15-24 and 33 is requested.

10. A copy of every patent or printed publication relied upon is submitted herewith including a listing thereof on Form PTO-1449.

11. There are no documents submitted that require English language translation.

REQUEST FOR REEXAMINATION OF
U.S. PATENT NO. 6,181,990

12. The attached detailed request includes at least the following items:

(a) A statement identifying each substantial new question of patentability based on prior patents and printed publications (37 CFR 1.510(b)(1)).

(b) An identification of every claim for which reexamination is requested, and a detailed explanation of the pertinency and manner of applying the cited prior art to every claim for which reexamination is requested (37 CFR 1.510(b)(2)).

13. A proposed Amendment is not included.

14. It is certified that a copy of this request has been served in its entirety on the patent owner and on the last known legal representative as provided in 37 CFR 1.33(c).

The name and address of the parties served and the date of service are listed below.

The service copies were sent via U.S. Express Mail on August 12, 2003 to:

Teledyne Industries, Inc.
12333 West Olympic Boulevard
Los Angeles, California 90064-1021

AND

Mark R. Leslie, Esq.
Kirkpatrick & Lockhart, LLP
Henry W. Oliver Building
535 Smithfield Street
Pittsburgh, Pennsylvania 15222

REQUEST FOR REEXAMINATION OF
U.S. PATENT NO. 6,181,990

15. The requestor's correspondence address is: Christopher F. Regan, Esquire, Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A., 255 South Orange Avenue, Suite 1401, Post Office Box 3791, Orlando, Florida 32801.

16. The patent is not currently the subject of any known concurrent proceeding(s).

PLEASE ADDRESS ALL CORRESPONDENCE TO ATTORNEY OF RECORD:
CHRISTOPHER F. REGAN

06/27/2002 03/18/2003

Please associate this reexamination with Customer No. 27975.

27975

PATENT TRADEMARK OFFICE

Respectfully submitted,

RICHARD K. WARTHER
Reg. No. 32,180
Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.
255 S. Orange Avenue, Suite 1401
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407/841-2330
For Third Party Requestor

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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PATENT & TRADEMARK OFFICE

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EXPRESS MAIL NO: EV 322683106 US

DATE OF DEPOSIT: August 12, 2003

NAME: Justin Gorse

SIGNATURE: Justin Gorse

REQUEST FOR REEXAMINATION OF
U.S. PATENT NO. 6,181,990

ATTORNEY DOCKET NO. GCSD-1360 (51298)

08/08/2003 ...

CERTIFICATE OF EXPRESS MAIL

Sir:

The enclosed **REQUEST FOR REEXAMINATION, ATTACHMENT TO REQUEST FOR REEXAMINATION PROVIDING INFORMATION OF PATENT NO. 6,181,990, including Exhibits of OFFICE ACTIONS, AMENDMENTS and CITATION UNDER 37 CFR §1.97** are being mailed by Express Mail No. **EV322683106US** on this 12th day of August, 2003.

Respectfully submitted,

RICHARD K. WARTHER
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407/841-2330

ATTORNEY DOCKET NO. GCSD-1360 (51298)

ATTACHMENT TO REQUEST FOR REEXAMINATION
PROVIDING INFORMATION OF PAT. NO. 6,181,990

Sir:

Reexamination under 35 U.S.C. 302-307 and 37 CFR 1.510 is requested of United States Patent No. 6,181,990, which issued on January 30, 2001 to Grabowsky et al. This patent is believed to be still enforceable.

I. Requestor's Copied Claims Were Found Unpatentable by the Patent Office:

Background

On October 11, 2001, a continuation application serial no. 09/976,647 (hereinafter "'647 application") was filed by requestor that relates priority to a grandparent application serial no. 08/557,269, filed November 14, 1995, now U.S. Patent No. 6,047,165. Requestor filed an Amendment under 37 C.F.R. §1.607 on January 23, 2002, copying claims 1-4, 6, 7, 15-24 and 33 of U.S. Patent No. 6,181,990 to Grabowsky et al. (hereinafter "Grabowsky et al."), issued January 30, 2001, the patent which this examination is being requested, to provoke an interference with the Grabowsky et al. patent. The copied claims correspond to Claims 59-75 in the Requestor's '647 application. A copy of this Amendment is attached as Exhibit 1.

In an Office Action mailed August 9, 2002, and signed by a Primary Examiner for Art Unit 2632 and the Director, TC 2600 (Exhibit 2), the U.S. Patent and Trademark Office stated that copied claims 1, 4, 6, 7, 15-20 and 33 of Grabowsky, corresponding to Claims 59, 62-70 and 75 of Requestor's '647 application, were not patentable because those

copied claims were anticipated by U.S. Patent No. 5,351,194 to Ross et al. Copied claims 2, 3, 21 and 22 corresponding to Claims 60, 61, 71 and 72 in the Requestor's '647 application were held obvious over Ross et al. in view of U.S. Patent No. 5,652,717 to Miller et al. and U.S. Patent No. 5,943,399 to Bannister et al. Copied Claims 23 and 24 corresponding to Claims 73 and 74 in the '647 application were held obvious over Ross et al. in view of U.S. Patent No. 5,463,656 to Polivka et al.

Requestor responded in an Amendment filed February 4, 2003, by placing dependent Claims 60, 61, 71 and 72 into independent format, arguing the patentability of those claims, and that because those claims were patentable, an interference should be declared (Exhibit 3). In a Final Office Action dated June 12, 2003, the Examiner upheld the rejection of all claims (Exhibit 4). A copy of the Office Actions stating that copied claims corresponding to claims in Grabowsky et al. are unpatentable are enclosed as Exhibits 2 and 4, together with Requestor's Amendment under 37 CFR §1.607, filed January 23, 2002 (Exhibit 1) and the Amendment of February 4, 2003 (Exhibit 3).

II. Claims For Which Reexamination is Requested:

A. Reexamination Based on References Cited by Patent Office in Requestor's '647 Application

If the copied claims from Grabowsky et al. are unpatentable to Requestor, as determined by the Patent Office, then the Patent Office should also find that the same references should raise a substantial new question of patentability of these claims in the Grabowsky et al. patent. Accordingly, reexamination is requested of Claims 1, 4, 6, 7, 15-20 and 33, as anticipated by Ross et al., issued September 27, 1994, which is listed on the attached Information Disclosure Statement form and of which a copy is enclosed.

Reexamination is also requested for Claims 2, 3, 21 and 22 as obvious over Ross et al. in view of Miller et al., issued July 29, 1997, further in view of Bannister et al., issued August 24, 1999, copies which are listed on the attached Information Disclosure Statement form and of which copies are enclosed.

Reexamination is also requested for Claims 23 and 24 as obvious over Ross et al. in view of U.S. Patent No. 5,463,656 to Polivka et al., which is listed on the attached Information Disclosure Statement form and of which a copy is enclosed.

B. Reexamination Based on Requestor's Patents

Reexamination is also requested for Claims 1-4, 6, 7, 15-24 and 33 as anticipated by U.S. Patent No. 6,047,165 to Wright et al., issued April 4, 2000, which is listed on the attached Information Disclosure Statement form and of which a copy is enclosed.

Other patents claiming the same priority date and having the same disclosure as the Wright '165 patent are also listed on the attached Information Disclosure Statement: U.S. Patent Nos. 6,104,914; 6,108,523; 6,154,637; and 6,308,045, and issued respectively on August 15, 2000; August 22, 2000; November 28, 2000; and October 23, 2001.

III. Explanation of Pertinency and Manner of Applying Cited Prior Art to Every Claim for which Reexamination is Requested Based on Prior Art:

A. Claims Anticipated by Ross et al.

The United States Patent and Trademark Office has determined that Claims 59, 62-70 and 75 in the '647 application corresponding to Claims 1, 4, 6, 7, 15-20 and 33 of Grabowsky et al. are fully anticipated under 35 U.S.C. §102 by Ross et al.. The language used by the Primary Examiner and Director

in the original Office Action of August 9, 2002 for the '647 application is set forth below explaining the pertinency and manner of applying Ross et al. to the claims at issue. Some claim numbers from Grabowsky et al. are followed by the claim number (in parenthesis) corresponding to the Requestor's '647 application. Claims 1, 4, 6, 7, 15-29 and 33 of Grabowsky et al. are quoted below:

Claim of Grabowsky et al.	Patent Office Rejection From Requestor's '647 Application
1. An aircraft data transmission system,	Ross shows an aircraft data transmission system
the aircraft having a data acquisition unit, comprising:	the aircraft having a data acquisition unit 10
a communications unit located in the aircraft and in communication with the data acquisition unit; a cellular infrastructure in communication with said communications unit after the aircraft has landed,	comprising a communication unit 24 located in the aircraft and in communication with the data acquisition unit 10, a cellular infrastructure (column 4, lines 40-50) in communication with the communication unit 10 after the aircraft has landed,
wherein the communication is initiated automatically upon landing of the aircraft; and	wherein the communication is initiated automatically upon landing of the aircraft;
a data reception unit in communication with said cellular infrastructure.	and a data reception unit 32 in communication with the cellular infrastructure, see column 5, lines 48 et seq., wherein after the aircraft has landed, a second switch 14 communicates with the controller 10; further in column 6, lines 13-36, acquired aircraft data is automatically communicated to the flight center's controller 32 upon the aircraft being downed. The term downed equates to landing.
4. The system of claim 1 wherein said communications unit has at least one modem in communication with said cellular infrastructure and said data reception unit has at least one modem in communication with said cellular infrastructure.	With respect to claim 4 (62), Ross discloses a modem, column 6, lines 48-51.

Claim of Grabowsky et al.	Patent Office Rejection From Requestor's '647 Application
6. The system of claim 1 wherein said cellular infrastructure includes: an antenna; a transceiver subsystem in communication with said antenna; and a controller in communication with said transceiver subsystem.	With respect to claim 6 (63), an antenna is inherent in cellular infrastructures of Ross.
7. The system of claim 1 wherein said data reception unit includes: a router; and a processor in communication with said router, said processor having a storage unit.	With respect to claim 7 (64), the cited "router" is inherent in the cellular infrastructure of Ross are conventionally associated with cell infrastructures.
15. An aircraft data transmission system, the aircraft having a data acquisition unit, comprising:	Ross shows an aircraft data transmission system, the aircraft having a data acquisition unit 10
means for transmitting data from the data acquisition unit via a cellular infrastructure after the aircraft has landed,	comprising a communication unit 24 located in the aircraft and in communication with the data acquisition unit 10; a cellular infrastructure (column 4, lines 40-50) in communication with the communication unit 10 after the aircraft has landed,
wherein transmission of the data is initiated automatically upon landing of the aircraft; and	wherein the communication is initiated automatically upon landing of the aircraft;

Claim of Grabowsky et al.	Patent Office Rejection From Requestor's '647 Application
means for receiving said data from said cellular infrastructure.	and data reception unit 32 in communication with the cellular infrastructure, see column 5, lines 48 et seq., wherein after the aircraft has landed, a second switch 14 communicates with the controller 10; further in column 6, lines 13-36, acquired aircraft data is automatically communicated to the flight center's controller 32 upon the aircraft being downed. The term downed equates to landing. Also see claims 12 and 13. Accordingly, Ross clearly anticipates these claims in disclosing the automatic activation of a switch associated with the landing or downing of the aircraft in which relevant acquired data is communicated through a cellular infrastructure to a ground base receiver. Claims 15, 18 and 19 (65, 68 and 69) are clearly met by Ross as discussed above.
16. The system of claim 15 wherein said means for transmitting data includes a processor.	Acquisition unit 10 is a processor operative with a keyboard 16.
17. The system of claim 15 wherein said means for receiving data includes a processor.	With respect to claim 17 (67), receiver for data can be a main frame, column 5, lines 1-4.
18. A method of transmitting aircraft flight data from an aircraft, comprising: receiving flight data from a data acquisition unit;	Ross shows an aircraft data transmission system, the aircraft having a data acquisition unit 10 comprising a communication unit 24 located in the aircraft and in communication with the data acquisition unit 10;
transmitting said flight data via a cellular communications infrastructure after the aircraft has landed,	a cellular infrastructure (column 4, lines 40-50) in communication with the communication unit 10 after the aircraft has landed.

Claim of Grabowsky et al.	Patent Office Rejection From Requestor's '647 Application
wherein the cellular communications infrastructure is accessed automatically upon landing of the aircraft; and receiving said transmitted flight data.	wherein the communication is initiated automatically upon landing of the aircraft; and a data reception unit 32 in communication with the cellular infrastructure, see column 5, lines 48 et seq., wherein after the aircraft has landed, a second switch 14 communicates with the controller 10; further in column 6, lines 13-36, acquired aircraft data is automatically communicated to the flight center's controller 32 upon the aircraft being downed. The term downed equates to landing. Also, see claims 12 and 13. Accordingly, Ross clearly anticipates these claims in disclosing the automatic activation of a switch associated with the landing or downing of the aircraft in which relevant acquired data is communicated through a cellular infrastructure to a ground base receiver. Claims 15, 18 and 19 (65, 68 and 69) are clearly met by Ross as discussed above.
19. A computer-implemented method of transmitting aircraft flight data from an aircraft, comprising: receiving flight data from a digital flight data acquisition unit;	Ross shows an aircraft data transmission system, the aircraft having a data acquisition unit 10. With respect to claim 19 (69) recitation of a digital flight data acquisition unit, Ross discloses controller 10 can be a TI Travelmate 4000, column 6, lines 37-40.
processing said flight data to prepare said data for transmission; and	comprising a communication unit 24 located in the aircraft and in communication with the data acquisition unit 10; a cellular infrastructure (column 4, lines 40-50) in communication with the communication unit 10 after the aircraft has landed,

Claim of Grabowsky et al.	Patent Office Rejection From Requestor's '647 Application
transmitting said processed data via a cellular infrastructure after the aircraft has landed,	wherein the communication is initiated automatically upon landing of the aircraft; and a data reception unit 32 in communication with the cellular infrastructure, see column 5, lines 48 et seq., wherein after the aircraft has landed, a second switch 14 communicates with the controller 10; further in column 6, lines 13-36, acquired aircraft data is automatically communicated to the flight center's controller 32 upon the aircraft being downed. The term downed equates to landing.
wherein the cellular infrastructure is accessed automatically upon landing of the aircraft.	Accordingly, Ross clearly anticipates these claims in disclosing the automatic activation of a switch associated with the landing or downing of the aircraft in which relevant acquired data is communicated through a cellular infrastructure to a ground base receiver.. Claims 15, 18 and 19 (65, 68 and 69) are clearly met by Ross as discussed above.
20. The method of claim 19 further comprising receiving said transmitted data at a flight operations center.	Flight control center 30.
33. A computer readable medium having stored thereon instructions which when executed by a processor, cause the processor to perform the steps of:	Claim 33 (75) clearly met by Ross with respect to processors in both the aircraft and the ground station each processing information with respect to a computer readable medium as illustrated in the flow chart in Figure 2.
receiving flight data from a digital flight data acquisition unit in an aircraft;	Ross shows an aircraft data transmission system, the aircraft having a data acquisition unit 10 comprising a communication unit 24 located in the aircraft and in communication with the data acquisition unit 10;
processing said flight data to prepare said data for transmission; and	

Claim of Grabowsky et al.	Patent Office Rejection From Requestor's '647 Application
transmitting said processed data via a cellular infrastructure when said aircraft has landed,	a cellular infrastructure (column 4, lines 40-50) in communication with the communication unit 10 after the aircraft has landed, wherein the communication is initiated automatically upon landing of the aircraft; and a data reception unit 32 in communication with the cellular infrastructure, see column 5, lines 48 et seq., wherein after the aircraft has landed, a second switch 14 communicates with the controller 10; further in column 6, lines 13-36, acquired aircraft data is automatically communicated to the flight center's controller 32 upon the aircraft being downed. The term downed equates to landing. Also, see claims 12 and 13.
wherein the cellular infrastructure is accessed automatically upon landing of the aircraft.	Accordingly, Ross clearly anticipates these claims in disclosing the automatic activation of a switch associated with the landing or downing of the aircraft in which relevant acquired data is communicated through a cellular infrastructure to a ground base receiver.

60005742.081202

B. Claims Obvious Over Ross et al. in View of Miller and Bannister

The United States Patent and Trademark Office has determined that Claims 60, 61, 71 and 72 in the '647 application corresponding to Claims 2, 3, 21 and 22 of Grabowsky et al. are obvious under 35 U.S.C. §103 over Ross et al. in view of Miller and Bannister. The same language used by the Primary Examiner and Director in the Office Action for the '647 application is set forth below to explain the pertinency and manner of applying Ross et al., Miller and Bannister to the claims at issue. Each claim number from Grabowsky et al. is followed by the claim number (in parenthesis) corresponding to the Requestor's '647 application claim before it was amended in the February 4, 2003 Amendment. Claims 2, 3, 21 and 22 of Grabowsky et al. are quoted below:

Claim of Grabowsky et al.	Patent Office Rejection From Requestor's '647 Application
2. The system of claim 1 wherein said data reception unit is in communication with said cellular infrastructure via the Internet.	Claims 2, 3, 21 and 22 (60, 61, 71 and 72) are rejected under 35 U.S.C. 103(a) as being unpatentable over Ross et al. in view of Miller et al. (5,652,717) and Bannister. Miller shows in Figure 2 the acquisition of data from an aircraft 14, column 2, lines 34-45, and provides for a telecommunication network 22 and internet communication, column 3, lines 4-18, 65 et seq.
3. The system of claim 1 wherein said data reception unit is in communication with said cellular infrastructure via the public switch telephone network.	Miller is relied upon to show that it is conventional to manipulate the data received from the aircraft 14 through an internet connection 30. Claims 2 (60) and 21 (71) only recite that the data reception unit is in communication with the cellular infrastructure via the internet. Cellular infrastructure is clearly as 24 in Ross et al. The internet connection 30 which is at the reception unit provides an internet access as disclosed by Miller.
21. The method of claim 20 further comprising receiving said transmitted data and transmitting said received data via the Internet before receiving said transmitted data at a flight operations center.	Accordingly, it would have been obvious to one having ordinary skill in the art to provide an internet connection for communication purposes in a reception unit because the specific use of providing an internet connection for communication purposes in a reception unit concerned with aircraft data acquisition and transmission is clearly suggested by Miller. See column 3, lines 25-44, and specifically lines 40-44 for interactive internet support.

Claim of Grabowsky et al.	Patent Office Rejection From Requestor's '647 Application
22. The method of claim 20 further comprising receiving said transmitted data and transmitting said received data via the public-switched telephone network before receiving said transmitted data at a flight operations center.	Bannister shows a data acquisition system and provides for conventional PSTN interfaced with the internet. See Figure 1 and related disclosure. Accordingly, Bannister teaches the artisan the combined use of PSTN AND INTERNET. Accordingly, at the time the invention was made, the combined use of cellular communication, internet access, and PSTN are all well known and conventional as evidenced by the teachings of the references as discussed above. Once the skilled artisan recognizes that the internet is employed at the reception unit of Ross as suggested by Miller, the skilled artisan would further recognize the use and advantages of employing conventional PSTN cellular infrastructure for internet communication as evidenced by the teachings of Bannister. Patentable invention is not involved in employing internet connection through the cellular phone system such as conventional (PSTN), see Bannister.

EO2180.0824S0006

C. Claims Obvious Over Ross et al. in View of Polivka

The United States Patent and Trademark Office has determined that Claims 73 and 74 in the '647 application corresponding to Claims 23 and 24 of Grabowsky et al. are obvious under 35 U.S.C. §103 over Ross et al. in view of Polivka. The same language used by the Primary Examiner and Director in the Office Action for the Requestor's '647 application is set forth below to explain the pertinency and manner of applying Ross et al. and Polivka to the claims at issue. Each claim number from Grabowsky et al. is followed by the claim number (in parenthesis) corresponding to the '647 application. Claims 23 and 24 of Grabowsky et al. read as quoted below:

<u>Claim of Grabowsky et al.</u>	<u>Patent Office Rejection</u>
23. The method of claim 19 wherein processing said flight data includes: compressing said flight data; encrypting said flight data; segmenting said flight data; and constructing packets of data from said segmented flight data.	Claims 23 (73) and 24 (74) are rejected under 35 U.S.C. 103(a) as being unpatentable over Ross et al. in view of Polivka et al., cited by applicants. Polivka shows in an aircraft data acquisition and transmission means as shown in Figures 3a and 3b, and provides for the acquisition of data such as a video camera 327 Figure 3a, compressing (323, Figure 3a), encrypting (such as forward error correction encoder unit 330, Figure 3b), segmenting and constructing packets of data from the segmented flight data (PSK/SPREAD spectrum modulator 361 in Figure 3b). See column 10, lines 13 et seq.
24. The method of claim 19 wherein receiving said transmitted data includes: acknowledging receipt of said transmitted data; reassembling said received data; decrypting said reassembled data; uncompressing said decrypted data; and storing said uncompressed data.	With respect to claim 24 (74), the acknowledgment of receipt of the transmitted data is no more than the response due to the video teleconference as provided for in Polivka, column 10, such is no more than conventional bidirectional communication and would not involve patentable invention.

<u>D. Claims Anticipated by Requestor's Grandparent U.S. Patent No. 6,047,165</u>

Claims 1-4, 6, 7, 15-24 and 33 of Grabowsky et al. are fully anticipated under 35 U.S.C. §102 by the Wright et al. '165 patent. The same language used in the Amendment Under 37 C.F.R. §1.607 filed on January 23, 2002, in the Requestor's '647 application, having copied claims 1-4, 6, 7, 15-24 and 33 of Grabowsky et al., is set forth below. References are to the column and line number of the Wright et al. '165 patent, instead of including page and line references from the pending '647 application as in the '647 application.

Claim of Grabowsky et al.	Reference in the Wright et al. '165 Patent
1. An aircraft data transmission system,	Title: column 1, lines 1-5
the aircraft having a data acquisition unit, comprising:	DFDAU 16, column 8, lines 38-48; DFDR 18 operative with GDL 101, column 8, lines 59-64.
a communications unit located in the aircraft and in communication with the data acquisition unit;	GDL airborne segment 101, GDL unit 111, GDL antenna 113, column 7, lines 6-9; column 8, lines 38-48.
a cellular infrastructure in communication with said communications unit after the aircraft has landed,	FIG. 1A, circular cells defined by wireless routers 201 and base stations 202; FIG. 4, circular cells 214, 215; column 6, lines 50-52; column 9, lines 51-57. Column 15, lines 5-14 define the system as cellular infrastructure typical of cellular telephone network.
wherein the communication is initiated automatically upon landing of the aircraft; and	Column 16, lines 33-34; "that is automatically downloaded . . . when aircraft lands."
a data reception unit in communication with said cellular infrastructure.	Server/archive 204 in association with server/archive 304; column 7, lines 33-37.
2. The system of claim 1 wherein said data reception unit is in communication with said cellular infrastructure via the Internet.	Transmission Control Protocol/ Internet Protocol (TCP/IP) operative in Ethernet LAN 207 with TELCO connection (FIG. 1). Clearly defined use with Internet.
3. The system of claim 1 wherein said data reception unit is in communication with said cellular infrastructure via the public switch telephone network.	Server/archive 304, gateway segment 306 in communication with ground subsystem 200 via ISDN TELCO (FIG. 1); column 7, lines 44-46. TELCO is public switch telephone network.
4. The system of claim 1 wherein said communications unit has at least one modem in communication with said cellular infrastructure and	Network transceiver 26 naturally includes modem to modulate/ demodulate signals.

Claim of Grabowsky et al.	Reference in the Wright et al. '165 Patent
said data reception unit has at least one modem in communication with said cellular infrastructure.	Base station 202 naturally includes modem with server 204 to demodulate/modulate signals and operative with Ethernet LAN 207.
6. The system of claim 1 wherein said cellular infrastructure includes:	
an antenna;	Antenna 222, 223, FIG. 5, column 10, lines 32-39.
a transceiver subsystem in communication with said antenna; and	Transceiver 221, FIG. 5, lines 32-39.
a controller in communication with said transceiver subsystem.	Controller/processor 225, FIG. 5, column 10, lines 44-47.
7. The system of claim 1 wherein said data reception unit includes:	
a router; and	Router 201
a processor in communication with said router,	Server 304 in communication with router 201, FIG. 1; column 8, lines 1-8.
said processor having a storage unit.	Archive includes memory, database management software; column 8, lines 1-8.
15. An aircraft data transmission system, the aircraft having a data acquisition unit, comprising:	Title: column 1, lines 1-5. DFDAU 16, column 8, lines 38-48; DFDR 18 operative with GDL 101, column 8, lines 59-64.
means for transmitting data from the data acquisition unit via a cellular infrastructure after the aircraft has landed,	GDL airborne segment 101, GDL unit 111, GDL antenna 113, column 7, lines 6-9; column 8, lines 38-48. FIG. 1A, circular cells defined by wireless routers 201 and base stations 202; FIG. 4, circular cells 214, 215; column 6, lines 50-52; column 9, lines 51-57. Column 15, lines 5-14 define the system as cellular infrastructure typical of cellular telephone network.

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Claim of Grabowsky et al.	Reference in the Wright et al. '165 Patent
wherein transmission of the data is initiated automatically upon landing of the aircraft; and	Column 16, lines 33-34; "that is automatically downloaded . . . when aircraft lands."
means for receiving said data from said cellular infrastructure.	Server/archive 204 in association with server/archive 304; column 7, lines 33-37.
16. The system of claim 15 wherein said means for transmitting data includes a processor.	Processor 22, FIG. 3.
17. The system of claim 15 wherein said means for receiving data includes a processor.	Server 304 in communication with router 201, FIG. 1; column 8, lines 1-8.
18. A method of transmitting aircraft flight data from an aircraft, comprising:	Title: column 1, lines 1-5.
receiving flight data from a data acquisition unit;	DFDAU 16, column 8, lines 38-48; DFDR 18 operative with GDL 101, column 8, lines 59-64.
transmitting said flight data via a cellular communications infrastructure after the aircraft has landed,	FIG. 1A, circular cells defined by wireless routers 201 and base stations 202; FIG. 4, circular cells 214, 215; column 6, lines 50-52; column 9, lines 51-57. Column 15, lines 5-14 define the system as cellular infrastructure typical of cellular telephone network.
wherein the cellular communications infrastructure is accessed automatically upon landing of the aircraft; and	Column 16, lines 33-34; "that is automatically downloaded . . . when aircraft lands."
receiving said transmitted flight data.	Server/archive 204 in association with server/archive 304; column 7, lines 33-37.
19. A computer-implemented method of transmitting aircraft flight data from an aircraft, comprising:	Title: column 1, lines 1-5.

Claim of Grabowsky et al.	Reference in the Wright et al. '165 Patent
receiving flight data from a digital flight data acquisition unit;	DFDAU 16, column 8, lines 38-48; DFDR 18 operative with GDL 101, column 8, lines 59-64.
processing said flight data to prepare said data for transmission; and	GDL airborne segment 101, GDL unit 111, GDL antenna 113, column 7, lines 6-9; column 8, lines 38-48.
transmitting said processed data via a cellular infrastructure after the aircraft has landed,	FIG. 1A, circular cells defined by wireless routers 201 and base stations 202; FIG. 4, circular cells 214, 215; column 6, lines 50-52; column 9, lines 51-57. Column 15, lines 5-14 define the system as cellular infrastructure typical of cellular telephone network.
wherein the cellular infrastructure is accessed automatically upon landing of the aircraft.	Column 16, lines 33-34; "that is automatically downloaded . . . when aircraft lands."
20. The method of claim 19 further comprising receiving said transmitted data at a flight operations center.	FIG. 1 Remote Flight Operations Control Center 300.
21. The method of claim 20 further comprising receiving said transmitted data and transmitting said received data via the Internet before receiving said transmitted data at a flight operations center.	Transmission Control Protocol/ Internet Protocol (TCP/IP) operative in Ethernet LAN 207 with TELCO connection (FIG. 1). Clearly defined use with Internet.
22. The method of claim 20 further comprising receiving said transmitted data and	
transmitting said received data via the public-switched telephone network before receiving said transmitted data at a flight operations center.	Server/archive 304, gateway segment 306 in communication with ground subsystem 200 via ISDN TELCO (FIG. 1); column 7, lines 44-46.
23. The method of claim 19 wherein processing said flight data includes:	

Claim of Grabowsky et al.	Reference in the Wright et al. '165 Patent
compressing said flight data;	Source coding can be used for data compression. Aircraft data downloaded as compressed data. Column 11, lines 5-11 and 20-23.
encrypting said flight data;	Aircraft flight data is encrypted. Column 11, lines 5-7.
segmenting said flight data; and	Flight data is segmented into channels. Flight data is multiplexed. Column 11, lines 5-7 and 12-19.
constructing packets of data from said segmented flight data.	TCP/IP is packet protocol. FIG 1. System produces "flight performance data packet." Column 12, lines 57-59.
24. The method of claim 19 wherein receiving said transmitted data includes:	
acknowledging receipt of said transmitted data;	Polling occurs and receipts of packets acknowledged and retransmissions requested when errors occur. Standard use of TCP/IP. FIG. 1. Column 4, lines 7-30; column 16, lines 34-39.
reassembling said received data;	FIG. 1. Base station segment operative with wireless bridge segment and receives packets based on TCP/IP and operative with remote flight operations control center 300; Also operative with GDL work station segment 303 and controller 301 to acknowledge receipt, reassemble data, decrypt, uncompress and store for further use in server/archive 304.
decrypting said reassembled data;	
uncompressing said decrypted data; and	
storing said uncompressed data.	
33. A computer readable medium having stored thereon instructions which when executed by a processor, cause the processor to perform the steps of:	GDL unit includes processor 22 (FIG. 3) associated with memory 24 as stored instructions.

Claim of Grabowsky et al.	Reference in the Wright et al. '165 Patent
receiving flight data from a digital flight data acquisition unit in an aircraft;	Title: Column 1, lines 1-5. DFDAU 16, column 8, lines 38-48; DFDR 18 operative with GDL 101, column 8, lines 59-64.
processing said flight data to prepare said data for transmission; and	GDL airborne segment 101, GDL unit 111, GDL antenna 113, column 7, lines 6-9; column 8, lines 38-48.
transmitting said processed data via a cellular infrastructure when said aircraft has landed,	FIG. 1A, circular cells defined by wireless routers 201 and base stations 202; FIG. 4, circular cells 214, 215; column 6, lines 50-52; column 9, lines 51-57. Column 15, lines 5-14 define the system as cellular infrastructure typical of cellular telephone network.
wherein the cellular infrastructure is accessed automatically upon landing of the aircraft.	Column 16, lines 33-34; "that is automatically downloaded . . . when aircraft lands."

IV. Statement Pointing Out Substantial New Question of Patentability:

The prior art documents to Ross et al., Miller, Bannister and Polivka were not of record in the file of the Grabowsky et al. patent. The Wright et al. '165 patent was of record, but as noted by the Primary Examiner and Director in the Office Action received in Requestor's '647 application, the Wright et al. '165 patent has a specification supporting copied claims. Reexamination based on Wright et al. is permitted, even though Wright et al. is a cited reference in Grabowsky et al. based upon 35 U.S.C. §303(a) as amended on November 2, 2002, Public Law 107-273, Sec. 13105, 116 Stat. 1900, which states in its last sentence:

> "The existence of a substantial new question of patentability is not precluded by the fact that a patent or printed

publication was previously cited by or to
the Office or considered by the Office."

As determined by the United States Patent and Trademark Office, because claims corresponding to Claims 1-4, 6, 7, 15-24 and 33 of Grabowsky et al. are not patentable over these prior art documents, a substantial new question of patentability is raised.

Respectfully submitted,

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FORM PTO-1449
LIST OF PATENTS AND
INFORMATION DISCLOSURE STATEMENT

ATTORNEY DOCKET NO.: GCSD-1360 (51298)

REEXAMINATION REQUEST FOR
U.S. PATENT NO. 6,181,990 TO GRABOWSKY ET AL.

REFERENCE DESIGNATION — U.S. PATENT DOCUMENTS

EXAMINER INITIALS		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB CLASS	FILING IF APPROPRIATE
	AA	5,351,194	09/27/94	Ross et al.	364	449	
	AB	5,463,656	10/31/95	Polivka et al.	375	200	
	AC	5,652,717	07/29/97	Miller et al.	364	578	
	AD	5,943,399	08/24/99	Bannister et al.	379	88.17	
	AE	6,047,165	04/04/00	Wright et al.	455	66	
	AF	6,104,914	08/15/00	Wright et al.	455	66	
	AG	6,108,523	08/22/00	Wright et al.	455	66	
	AH	6,154,637	11/28/00	Wright et al.	455	66	
	AI	6,308,045	10/23/01	Wright et al.	455	66	
	AJ						
	AK						
	AL						
	AM						
	AN						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUB CLASS	TRANSLATION Yes -- No
	AO						
	AP						

OTHER ART
(Including Author, Title, Date, Pertinent Pages, etc.)

	AQ		
	AR		
	AS		

EXAMINER:	DATE CONSIDERED:

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; * Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

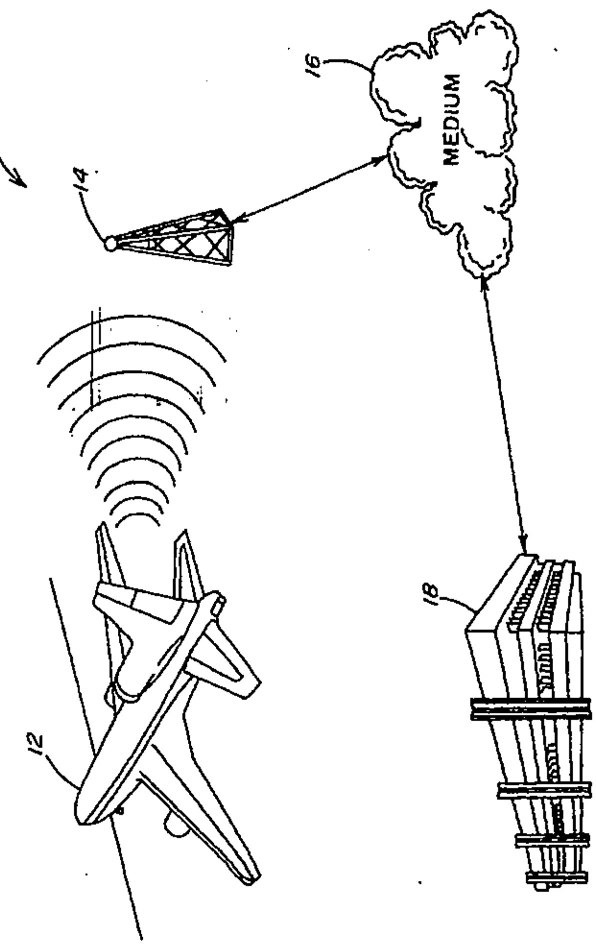
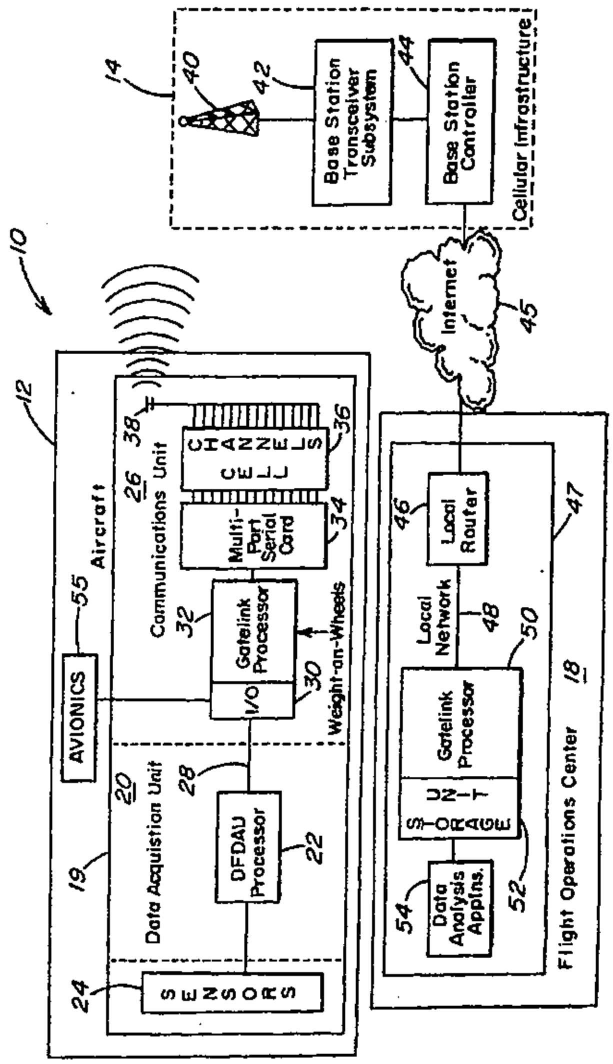


FIG. 1



14
40
42
Base Station Transceiver Subsystem
44
Base Station Controller
Cellular Infrastructure
10
Internet
45
12
Aircraft
Communications Unit
26
38
CHANNELS
CELL
36
Multi-Port Serial Card
34
55
AVIONICS
32
Gatelink Processor
I/O
30
Weight-on-Wheels
20
Data Acquistion Unit
28
19
DFDAU Processor
22
24
SENSORS
46
Local Router
47
Local Network
48
50
Gatelink Processor
STORAGE UNIT
18
Flight Operations Center
54
Data Analysis Applns.
52

FIG. 2

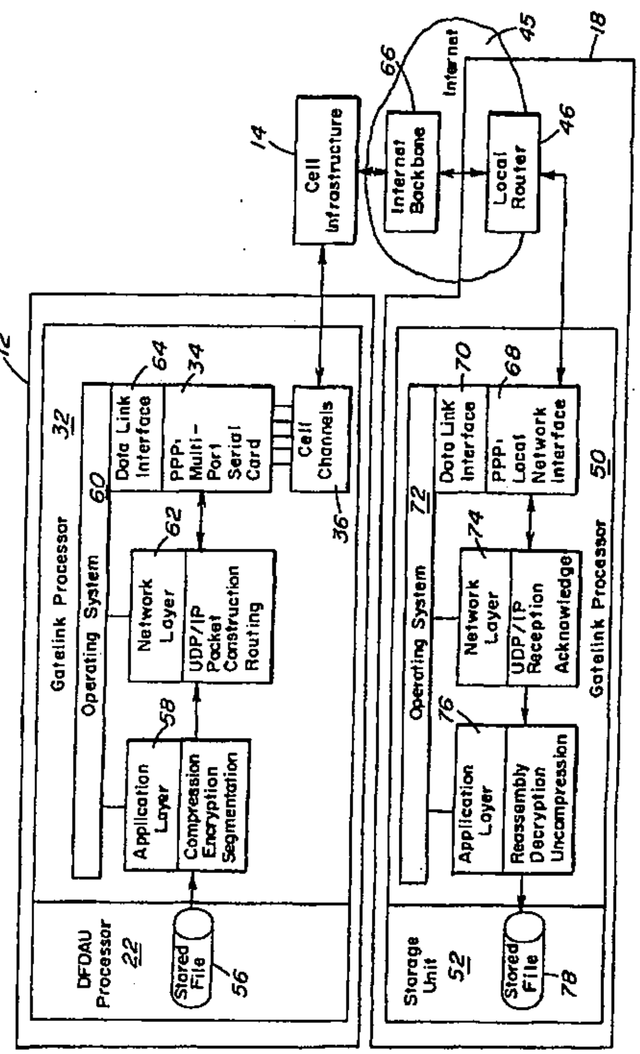


FIG. 3

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FIG. 4

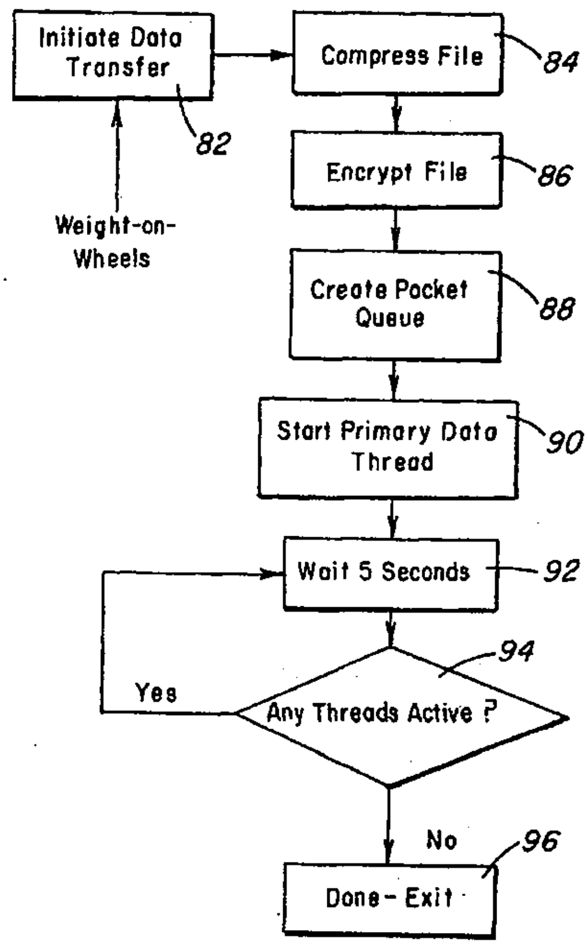

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FIG. 5

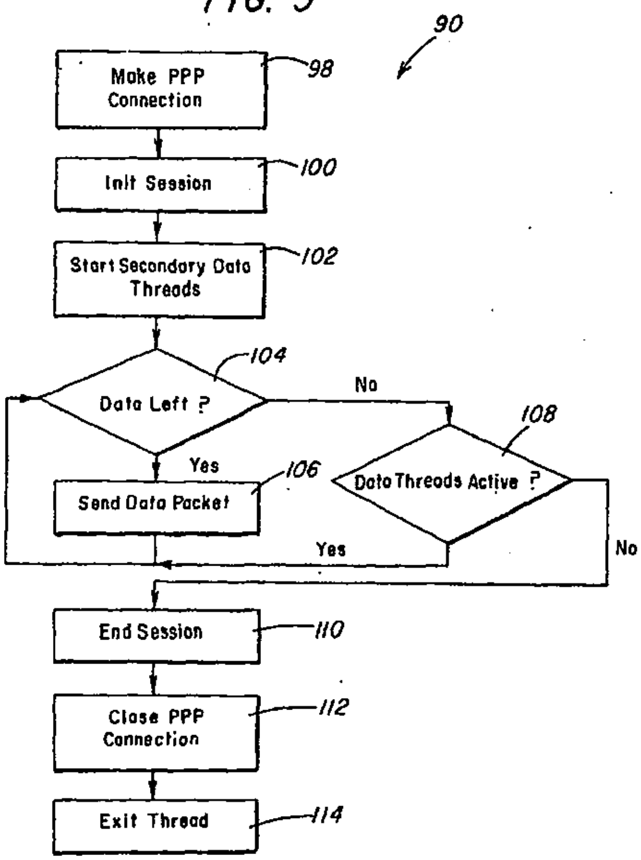

90
Make PPP Connection
98
Init Session
100
Start Secondary Data Threads
102
Data Left ?
104
No
Yes
Send Data Packet
106
Data Threads Active ?
108
Yes
No
End Session
110
Close PPP Connection
112
Exit Thread
114

FIG. 6

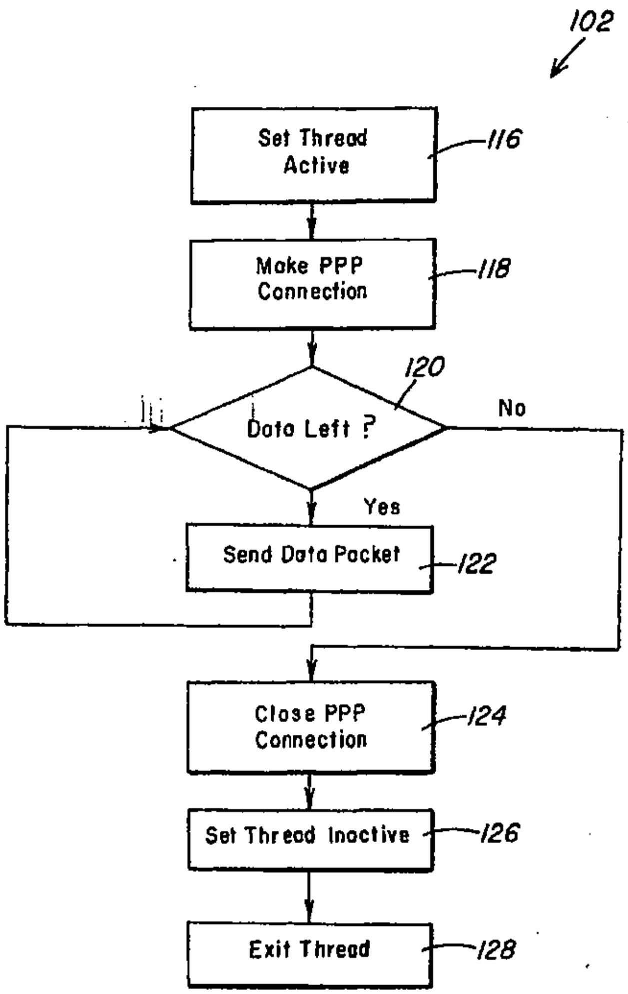

102
Set Thread Active
116
Make PPP Connection
118
120
Data Left ?
No
Yes
Send Data Packet
122
Close PPP Connection
124
Set Thread Inactive
126
Exit Thread
128

FIG. 7

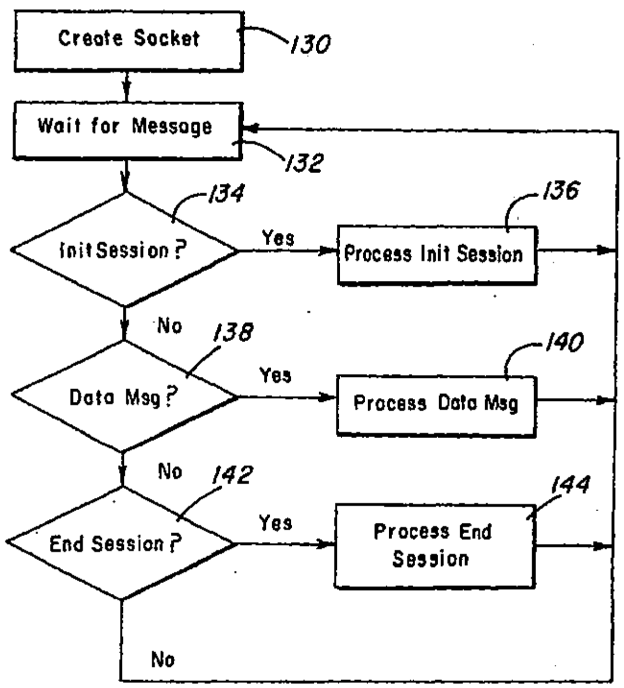

Create Socket
130
Wait for Message
132
134
Init Session ?
Yes
Process Init Session
136
No
138
Data Msg ?
Yes
Process Data Msg
140
No
142
End Session ?
Yes
Process End Session
144
No

FIG. 8

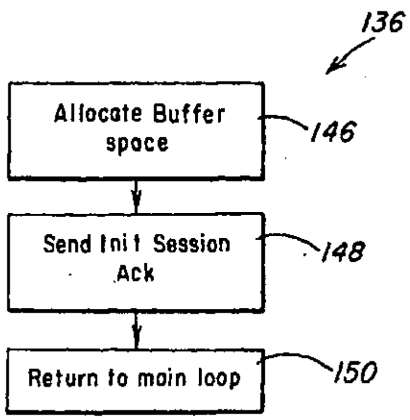

136
Allocate Buffer space
146
Send Init Session Ack
148
Return to main loop
150

FIG. 9

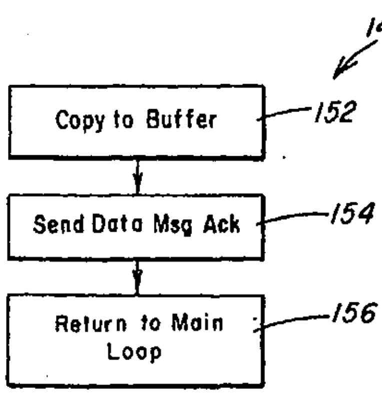
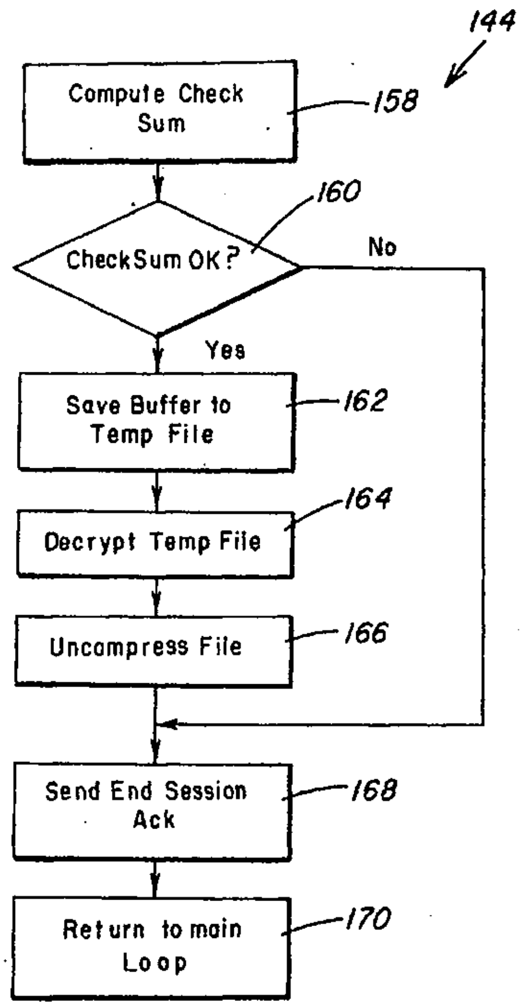

140
Copy to Buffer
152
Send Data Msg Ack
154
Return to Main Loop
156

FIG. 10


144
Compute Check Sum
158
CheckSum OK?
160
No
Yes
Save Buffer to Temp File
162
Decrypt Temp File
164
Uncompress File
166
Send End Session Ack
168
Return to main Loop
170

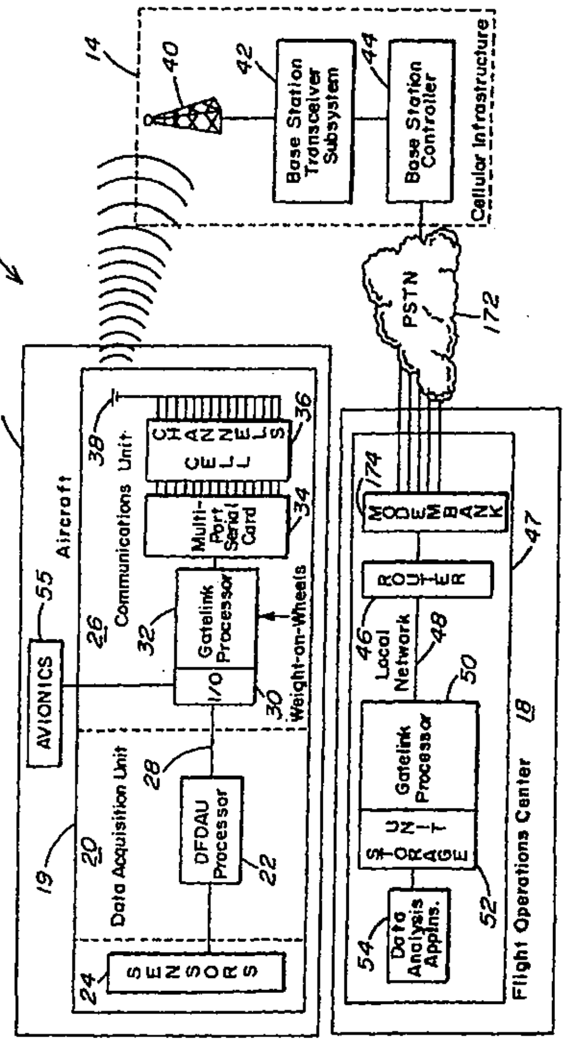


FIG. 11

09/03/2003, EAST Version: 1.04.0000

AIRCRAFT FLIGHT DATA ACQUISITION AND TRANSMISSION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

(Not Applicable)

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH

(Not Applicable)

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is directed generally to an aircraft flight data acquisition and transmission system and, more particularly, to an on-board cellular data transmission system.

2. Description of the Background

It is common for aircraft to generate records of data relating to flight and performance parameters for each flight of the aircraft. The data typically relate to parameters such as air speed, altitude, vertical acceleration, heading, time, etc. The data are utilized in the event of an accident or a near-accident and to assist in maintenance of the aircraft by detecting faulty components or gradual deterioration of a system or component, to assist in reviewing crew performance, and to assist in logistical planning activities such as scheduling and routing.

Aircraft data are typically gathered by a digital flight data acquisition unit (DFDAU). The DFDAU typically stores the data on magnetic or magnetic-optical media. When the aircraft lands, ground personnel board the aircraft, remove the media, and mail the media to a flight operations center (FOC). The manual removal and posting of the data adds a significant labor cost, yields less than desirable data delivery reliability, and results in a significant time delay before the data are useful for analysis.

It is known to use radio frequency (RF) transmissions to transmit data relating to an aircraft. Such teachings, however, require substantial investments to construct the RF transmission systems required for such a system to work. Furthermore, it is very expensive to create redundancy in such a system.

It is also known to transmit data relating to an aircraft via a telephone system located in a terminal. Such a system, however, requires that the aircraft be docked at the gate before transmission begins, thereby resulting in a substantial delay in the transmission. Furthermore, such a system requires an added step of transmitting the data from the aircraft to the terminal telephone system, increasing the cost of installing, operating, and maintaining such a system.

Thus, there is a need for an aircraft data transmission system that automatically transfers flight data from an aircraft to a flight operations center with little or no human involvement and which relies on a reliable wireless delivery system.

SUMMARY OF THE INVENTION

The present invention is directed to an aircraft data transmission system used with an aircraft having a data acquisition unit. The system includes a communications unit located in the aircraft and in communication with the data acquisition unit. The system also includes a cellular infrastructure in communication with the data communications unit after the aircraft has landed. The system further includes a data reception unit in communication with the cellular infrastructure.

The present invention represents a substantial advance over prior aircraft data acquisition and transmission systems. For example, the present invention has the advantage that it requires little expense to implement because it uses well-known technology and the cellular infrastructure which is already in place. The present invention also has the advantage that it can transmit data over multiple parallel channels to achieve the necessary transmission bandwidth and achieve a low data transmission time. The present invention has the further advantage that it does not require a dedicated data link between the aircraft and the flight operations center and/or an airport terminal.

BRIEF DESCRIPTION OF THE DRAWING

For the present invention to be clearly understood and readily practiced, the present invention will be described in conjunction with the following figures, wherein:

FIG. 1 illustrates an aircraft data acquisition and transmission system;

FIG. 2 is a block diagram illustrating a more detailed embodiment of the system illustrated in FIG. 1;

FIG. 3 is a block diagram illustrating data flow through the system illustrated in FIG. 2;

FIG. 4 is a flowchart illustrating a method carried out by the gatelink processor in the aircraft;

FIG. 5 is a flowchart illustrating a method of performing the start primary data thread step of FIG. 4;

FIG. 6 is a flowchart illustrating a method of performing the start secondary data threads step of FIG. 5;

FIG. 7 is a flowchart illustrating a method of operating the gatelink processor in the flight operations center;

FIG. 8 is a flowchart illustrating a method of performing the initialize session process step of FIG. 7;

FIG. 9 is a flowchart illustrating a method of performing the data message process step of FIG. 7;

FIG. 10 is a flowchart illustrating a method of performing the end session process step of FIG. 7; and

FIG. 11 is a block diagram illustrating another embodiment of the system illustrated in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

It is to be understood that the figures and descriptions of the present invention have been simplified to illustrate elements that are relevant for a clear understanding of the present invention, while eliminating, for purposes of clarity, other elements found in a typical communications system. It can be recognized that other elements are desirable and/or required to implement a device incorporating the present invention. For example, the details of the cellular communications infrastructure, the Internet, and the public-switched telephone network are not disclosed. However, because such elements are well known in the art, and because they do not facilitate a better understanding of the present invention, a discussion of such elements is not provided herein.

FIG. 1 illustrates an aircraft data acquisition and transmission system 10. An aircraft 12, which has stored flight data, is illustrated after landing. The aircraft 12 transmits flight data as cellular communications signals to a cellular infrastructure 14. The cellular infrastructure 14 acts as a

communications channel to the communications medium 16. A flight operations center 18 is connected to the medium 16 by any conventional connectivity medium such as, for example, a leased line. Once the cellular connections are made via the medium 16 data can flow bidirectionally from or to the aircraft.

FIG. 2 is a block diagram illustrating a more detailed embodiment of the system 10 illustrated in FIG. 1. The aircraft 12 includes a data system 19 having a data acquisition unit 20. The data acquisition unit 20 includes a digital flight data acquisition unit (DFDAU) processor 22, which includes a storage media for storing flight data in a digital format. The DFDAU processor 22 receives signals from sensors 24 which sense parameters such as air speed, altitude, vertical acceleration, heading, time, etc. The flight data are transferred to a communications unit 26 via a bus 28. The bus 28 is connected to an I/O interface 30 in the communications unit 26. The I/O interface 30 can be a standard bus interface such as, for example, an ARINC 429 bus interface.

The I/O interface 30 is connected to a gatelink processor 32. The processor 32 can be a general purpose processor such as a personal computer, a microprocessor such as an Intel Pentium® processor, or a special purpose processor such as an application specific integrated circuit (ASIC) designed to operate in the system 10. The processor 32 is responsive to a weight-on-wheels signal, which acts as an interrupt signal to signal the processor 32 to initiate transmission or reception of the data when the aircraft 12 has landed. Upon receipt of the weight-on-wheels signal from the landing gear of the aircraft 12, the processor 32 prepares the flight data for transmission and transmits the data to a multi-port serial card 34. Each I/O port of the card 34 is attached to a cell channel which can open, sustain, and close a physical, over-the-air channel to the cellular infrastructure 14. The cell channels 36 can transmit simultaneously and can thus transmit data in parallel. Each cell channel 36 is connected to an antenna matching network and a post amplifier (not shown). An antenna 38 is installed in the aircraft 12 so as to optimize free space radiation to the cellular infrastructure 14.

The data are transmitted over a cellular airlink using the physical layer modulation of the cellular infrastructure 14. The cellular infrastructure 14 includes an antenna 40, which is within free-space radiating range of the aircraft 12. The antenna 40 is connected to a base station transceiver subsystem 42. The subsystem 42 is connected to a base station controller 44 which has a direct connection via a router (not shown) to the Internet 45. The flight data are transmitted via the Internet 45 to the flight operations center 18.

A local router 46 in a data reception unit 47 of the flight operations center 18 is connected to the Internet 45, such as via a connection to the backbone of the Internet 45. The router 46 connects a local area network 48 to the Internet 45. The local area network can be of any type of network such as, for example, a token ring network, an ATM network, or an Ethernet network. A gatelink processor 50 is connected to the network 48 and receives the flight data for storage in an attached storage unit 52. The storage unit 52 can be any type of unit capable of storing data such as, for example, a disk array or a tape drive. The storage unit 52 makes the flight data available to data analysis applications 54 which can analyze and/or report the flight data to a user.

Data transfer can also occur from the flight operations center 18 to the aircraft 12. The data are transmitted via the Internet 45 and the cellular infrastructure 14 and received by the antenna 38. The serial card 34 receives the data from the cell channels 36 and the processor 32 outputs the data, via the I/O interface 30, to avionics 55.

FIG. 3 is a block diagram illustrating data flow through the system 10 illustrated in FIG. 2. The flight data is stored in the DFDAU processor 22 as a stored file 56. An application layer 58 of an operating system 60 of the gatelink processor 32 compresses, encrypts, and segments the data. The operating system 60 can be any type of operating system suitable such as, for example, UNIX. A typical stored file may be compressed from approximately 40 Mbytes to approximately 4 Mbytes. Compression may be done by any compression method such as, for example, the method embodied in the PKZIP® compression utility, manufactured by PKWARE, Inc. Encryption can be accomplished using any suitable asymmetric (public key) or symmetric encryption method such as, for example, the method embodied in Data Encryption Software (DES), manufactured by American Software Engineering or the methods in the RC2, RC4, or RC5 encryption software manufactured by RSA Data Security, Inc. During segmentation individual datagrams of, for example, 1024 bytes are formed and indexed for subsequent reassembly.

The operating system 60 passes the datagrams to a network layer 62 which constructs UDP/IP packets from the datagrams by adding message headers to the datagrams. The network layer 62 then routes the packets to one of up to 16 peer-to-peer protocol (PPP) threads running within the operating system 60 at a data link layer interface 64. The PPP threads convey the packets to the multi-port serial card 34 for transmission to the backbone 66 of the Internet 45 via the cell channels 36 to the cellular infrastructure 14. The packets are received from the Internet 45 by the local router 46 in the flight operations center 18. The network layer 62 receives acknowledgments of received packets from the gatelink processor 50 in the flight operations center 18. The network layer 62 also re-queues packets that are dropped before reaching the gatelink processor 50.

The local router 46 in the flight operations center 18 receives the packets and routes them to the gatelink processor 50. A local network interface 68 receives the packets and a data link layer interface 70 of an operating system 72 passes the packets to a network layer 74 of the operating system 72. The operating system 72 can be any type of suitable operating system such as, for example, UNIX. The network layer 74 sends acknowledgments of successful packet deliveries to the gatelink processor 32. The network layer 74 also removes the UDP/IP headers and passes the datagrams to an application layer 76. The application layer 76 reassembles, decrypts, and uncompresses the datagrams to restore the flight data to its original form. The application layer then passes the data to a stored file 78 in the storage unit 52. The functions performed by the aircraft 12 and the flight operations center 18 are similarly interchangeable when data is transferred from the flight operations center 18 to the aircraft 12.

FIG. 4 is a flowchart illustrating a method carried out by the gatelink processor 32 in the aircraft. At step 82, the gatelink processor 32 receives a weight-on-wheels interrupt which signals that the aircraft has landed, and the data transfer is initiated. The application layer 58 compresses the flight data at step 84 and encrypts the data at step 86. At step 88, the data is segmented into datagrams and UDP/IP packets are constructed. The packets are then placed in a packet queue. The packets are then ready for transmission as a fixed number of threads, corresponding to the number of cell channels 36. At step 90, the primary data thread is

started to make the initial call and open the communications channel to the flight operations center 18. A wait state at step 92 is invoked for a predetermined period of time (5 sec.) and at step 94, the processor 32 determines if any threads are active, i.e. if there are any packets that haven't been transmitted or have been transmitted and dropped. If there are no packets remaining, the method is completed at step 96. If there are packets remaining, the method enters the wait state at step 92 and subsequently determines if any threads are active at step 94.

FIG. 5 is a flowchart illustrating a method of performing the start primary data thread step 90 of FIG. 4. At step 98, the point-to-point protocol (PPP) connection is initiated for the primary data thread through one of the cell channels 36 and the gatelink session is initiated at step 100. The secondary data thread transmissions are started at step 102. At step 104, it is determined if any packets are left in the primary data thread to be transmitted. If so, the next packet in the primary data thread is transmitted at step 106. If no packets are left to transmit in the primary data thread as determined at step 104, it is determined if any of the secondary data threads are active at step 108. If so, the process returns to step 104 and repeats step 108 until no threads are active. If no threads are active, the gatelink session is ended at step 110 and the PPP connection for the primary data thread is closed at step 112. At step 114, the primary data thread step 90 is completed.

FIG. 6 is a flowchart illustrating a method of performing the start secondary data threads step 102 of FIG. 5. The method is carried out in parallel for each secondary data thread. At step 116, the thread is set to active so that the processor 32 can determine if any threads are active at step 108 of FIG. 5. The PPP connection for the secondary data thread being transmitted is initiated at step 118. At step 120, it is determined if any packets remain in the data thread. If so, the packet is transmitted at step 122. If no packets remain in the data thread, the PPP connection is closed at step 124 and the thread is set to inactive at step 126. The method is completed at step 128.

FIG. 7 is a flowchart illustrating a method of operating the gatelink processor 50 in the flight operations center 18. At step 130, a socket is opened to allow the operating system 72 in the processor 50 to receive and transport messages across the Internet 45. At step 132, the processor 50 waits for a message from the Internet 16. When a message is received, the processor 50 determines if the message is a session initialization message at step 134. If the message is a session initialization message, the processor 50 executes the session initialization process at step 136. If the message is not a session initialization message at step 134, the processor 50 determines if the message is a data message at step 138. If the message is a data message, the processor 50 executes the data message process at step 140. If the message is not a data message, the processor 50 determines if the message is an end session message at step 142. If the message is an end session message, the processor 50 executes the end session process at step 144 and then returns to step 132 to wait for additional messages..

FIG. 8 is a flowchart illustrating a method of performing the initialize session process step 136 of FIG. 7. The processor 50 allocates buffer space for subsequent data reception at step 146. The processor 50 then sends a session initialized data acknowledgment to the processor 32 at step 148. At step 150, the flow returns to step 132 of FIG. 7.

FIG. 9 is a flowchart illustrating a method of performing the data message process step 140 of FIG. 7. At step 152, the received data message is copied to a buffer and an acknowledgment of the data received is sent at step 154. At step 156, the flow returns to step 132 of FIG. 7.

FIG. 10 is a flowchart illustrating the steps included in the end session process step 144 of FIG. 7. At step 158, the checksum is computed for the received data to check the integrity of the data. The checksum is checked at step 160 and, if it is correct, the processor 50 saves the buffer to a temporary file at step 162. The processor 50 then decrypts the file at step 164 and uncompresses the file at step 166. The processor 50 sends an end session acknowledge message to the processor 32 at step 168 and at step 170, the flow returns to step 132 of FIG. 7. If the checksum is not correct, the processor 50 sends an unsuccessful end session message, which notifies the processor 32 to resend the data.

FIG. 11 is a block diagram illustrating another embodiment of the system 10 illustrated in FIG. 1. The operation of the system 10 of FIG. 11 is similar to that described in conjunction with the system 10 of FIG. 2. However, the flight data is transmitted from the cellular infrastructure 14 to the flight operations center 18 via the public-switched telephone network 172. A modem bank 174 receives the data via the PSTN 172. The data is then routed by the router 46 to the processor 50 via the network 48. The modem bank 174 can have a modem dedicated to receive data transmitted by one of the cell channels 36.

While the present invention has been described in conjunction with preferred embodiments thereof, many modifications and variations will be apparent to those of ordinary skill in the art. For example, although the system has been described hereinabove as transferring data from the aircraft, the system can also be used to transfer data to the aircraft with no modifications in the system. Also, the system may be used to transmit data while the aircraft is in flight. Furthermore, the system may be used without encryption and without data compression prior to sending data. The foregoing description and the following claims are intended to cover all such modifications and variations.

What is claimed is:

1. An aircraft data transmission system, the aircraft having a data acquisition unit, comprising:

a communications unit located in the aircraft and in communication with the data acquisition unit;

a cellular infrastructure in communication with said communications unit after the aircraft has landed, wherein the communication is initiated automatically upon landing of the aircraft; and

a data reception unit in communication with said cellular infrastructure.

2. The system of claim 1 wherein said data reception unit is in communication with said cellular infrastructure via the Internet.

3. The system of claim 1 wherein said data reception unit is in communication with said cellular infrastructure via the public switch telephone network.

4. The system of claim 1 wherein said communications unit has at least one modem in communication with said cellular infrastructure and said data reception unit has at least one modem in communication with said cellular infrastructure.

5. The system of claim 1 wherein said communications unit includes:

a processor;

a serial card in communication with said processor;

at least one cell channel in communication with said serial card; and

at least one antenna in communication with said cell channel.

6. The system of claim 1 wherein said cellular infrastructure includes:

an antenna;

a transceiver subsystem in communication with said antenna; and

a controller in communication with said transceiver subsystem.

7. The system of claim 1 wherein said data reception unit includes:

a router; and

a processor in communication with said router, said processor having a storage unit.

8. A data system for an aircraft, comprising:

a digital flight data acquisition unit in communication with at least one sensor;

a processor in communication with said digital flight data acquisition unit;

a serial card in communication with said processor; and

a plurality of cell channels in communication with said serial card, said cell channels for transmitting data via a cellular infrastructure after the aircraft has landed, wherein the communication between the cell channels and the serial card is initiated automatically upon landing of the aircraft.

9. The system of claim 8 further comprising an antenna in communication with said cell channels.

10. The system of claim 8 wherein said processor includes a personal computer.

11. The system of claim 8 wherein said processor includes an ASIC.

12. The system of claim 8 wherein said processor includes a microprocessor.

13. The system of claim 8 wherein said processor has an I/O interface in communication with said digital flight data acquisition unit.

14. An aircraft, comprising:

a digital flight data acquisition unit in communication with at least one sensor; and

a communications unit in communication with said digital flight data acquisition unit, said communications unit including:

a processor in communication with said digital flight data acquisition unit;

a serial card in communication with said processor; and

a plurality of cell channels in communication with said serial card, said cell channels for transmitting data via a cellular infrastructure after the aircraft has landed, wherein the communication between the cell channels and the serial card is initiated automatically upon landing of the aircraft.

15. An aircraft data transmission system, the aircraft having a data acquisition unit, comprising:

means for transmitting data from the data acquisition unit via a cellular infrastructure after the aircraft has landed, wherein transmission of the data is initiated automatically upon landing of the aircraft; and

means for receiving said data from said cellular infrastructure.

16. The system of claim 15 wherein said means for transmitting data includes a processor.

17. The system of claim 15 wherein said means for receiving data includes a processor.

18. A method of transmitting aircraft flight data from an aircraft, comprising:

receiving flight data from a data acquisition unit;

transmitting said flight data via a cellular communications infrastructure after the aircraft has landed, wherein the cellular communications infrastructure is accessed automatically upon landing of the aircraft; and

receiving said transmitted flight data.

19. A computer-implemented method of transmitting aircraft flight data from an aircraft, comprising:

receiving flight data from a digital flight data acquisition unit;

processing said flight data to prepare said data for transmission; and

transmitting said processed data via a cellular infrastructure after the aircraft has landed, wherein the cellular infrastructure is accessed automatically upon landing of the aircraft.

20. The method of claim 19 further comprising receiving said transmitted data at a flight operations center.

21. The method of claim 20 further comprising receiving said transmitted data and transmitting said received data via the Internet before receiving said transmitted data at a flight operations center.

22. The method of claim 20 further comprising receiving said transmitted data and transmitting said received data via the public-switched telephone network before receiving said transmitted data at a flight operations center.

23. The method of claim 19 wherein processing said flight data includes:

compressing said flight data;

encrypting said flight data;

segmenting said flight data; and

constructing packets of data from said segmented flight data.

24. The method of claim 19 wherein receiving said transmitted data includes:

acknowledging receipt of said transmitted data;

reassembling said received data;

decrypting said reassembled data;

uncompressing said decrypted data; and

storing said uncompressed data.

25. A computer-implemented method of transmitting aircraft flight data from an aircraft, comprising:

receiving flight data from a digital flight data acquisition unit;

processing said flight data to prepare said data for transmission; and

transmitting said processed data via a cellular infrastructure after the aircraft has landed, wherein processing said flight data includes:

receiving a weight-on-wheels signal;

initiating a data transfer;

compressing said flight data;

encrypting said compressed data;

creating a packet queue;

starting a primary data thread;

waiting a predetermined period of time;

determining if any threads are active;

repeating, when threads are active, the steps of waiting a predetermined period of time and determining if any threads are active; and

exiting processing said flight data when no threads are active.

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26. The method of claim 25 wherein starting a primary data thread includes:

initiating a PPP connection;

initiating a transfer session;

starting at least one secondary data thread;

determining if data remains in the primary data thread;

sending said data when data remains in the primary data thread;

determining if data threads are active when no data remains in the primary data thread;

repeating, when said threads are active, the step of determining if data remains in the primary data thread;

ending said session when no threads are active;

closing said PPP connection; and

exiting starting a primary data thread.

27. The method of claim 26 wherein starting at least one secondary data thread includes:

(a) setting the secondary data thread to active;

(b) initiating a PPP connection;

(c) determining if data remains in the secondary data thread;

(d) sending a data packet when data remains;

(e) repeating step c when data remains;

(f) closing said PPP connection when no data remains;

(g) setting the secondary data thread to inactive;

(h) exiting starting at least one secondary data thread; and

(i) repeating steps a through h for each secondary data thread.

28. The method of claim 27 wherein repeating steps a through h includes repeating steps a through h in parallel for each said secondary data thread.

29. A computer-implemented method of transmitting aircraft flight data from an aircraft, comprising:

receiving flight data from a digital flight data acquisition unit;

processing said flight data to prepare said data for transmission; and

transmitting said processed data via a cellular infrastructure after the aircraft has landed; and

receiving said transmitted data at a flight operations center, wherein receiving said transmitted data includes:

creating a socket;

receiving a message;

determining if said message is an initialization message;

initiating a session when said message is an initialization message;

determining if said message is a data message when said message is not an initialization message;

processing said message when said message is a data message;

determining if said message is an end session when said message is not a data message;

processing said message when said message is an end session; and

repeating, when said message is not an end session message, the step of receiving a message.

30. The method of claim 29 wherein initializing a session includes:

allocating buffer space;

sending an initiation session acknowledgment; and

returning to receiving a message.

31. The method of claim 29 wherein processing said message when said message is a data message includes:

copying said message to a buffer;

sending a data message acknowledgment; and

returning to receiving a message.

32. The method of claim 29 wherein processing said message when said message is not an end session includes:

computing a checksum;

determining if said checksum is valid;

saving a buffer to a temporary file;

decrypting said temporary file;

uncompressing said temporary file;

sending an end session acknowledgment; and

returning to receiving a message.

33. A computer readable medium having stored thereon instructions which when executed by a processor, cause the processor to perform the steps of:

receiving flight data from a digital flight data acquisition unit in an aircraft;

processing said flight data to prepare said data for transmission; and

transmitting said processed data via a cellular infrastructure when said aircraft has landed, wherein the cellular infrastructure is accessed automatically upon landing of the aircraft.

* * * * *

US006181990B1

(12) **United States Patent**
Grabowsky et al.

(10) Patent No.: **US 6,181,990 B1**
(45) Date of Patent: **Jan. 30, 2001**

(54) **AIRCRAFT FLIGHT DATA ACQUISITION AND TRANSMISSION SYSTEM**

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(73) Assignee: Teledyne Technologies, Inc., Los Angeles, CA (US)

(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

(21) Appl. No.: 09/126,156

(22) Filed: Jul. 30, 1998

(51) Int. Cl.[7] H04B 7/00; G06F 17/40; G06F 13/00

(52) U.S. Cl. 701/14; 701/35; 455/431

(58) Field of Search 701/14, 3, 24, 701/35; 455/431, 422, 456

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Assistant Examiner—Eric M Gibson
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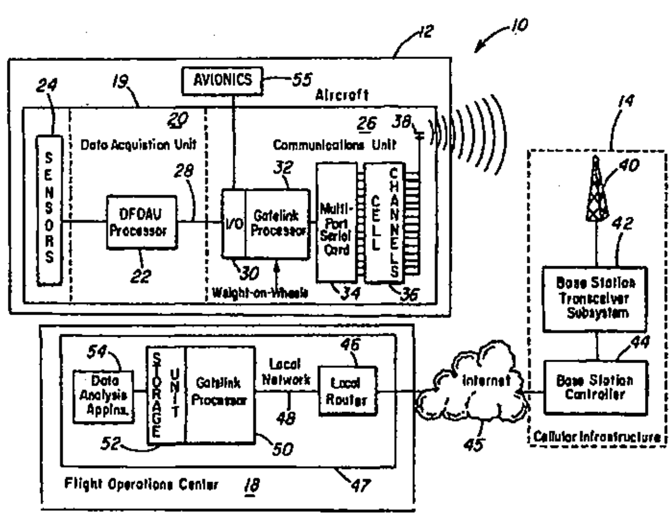
(57) **ABSTRACT**

An aircraft data transmission system used with an aircraft having a data acquisition unit. The system includes a communications unit located in the aircraft and in communication with the data acquisition unit. The system also includes a cellular infrastructure in communication with the data communications unit after the aircraft has landed. The system further includes a data reception unit in communication with the cellular infrastructure.

33 Claims, 10 Drawing Sheets



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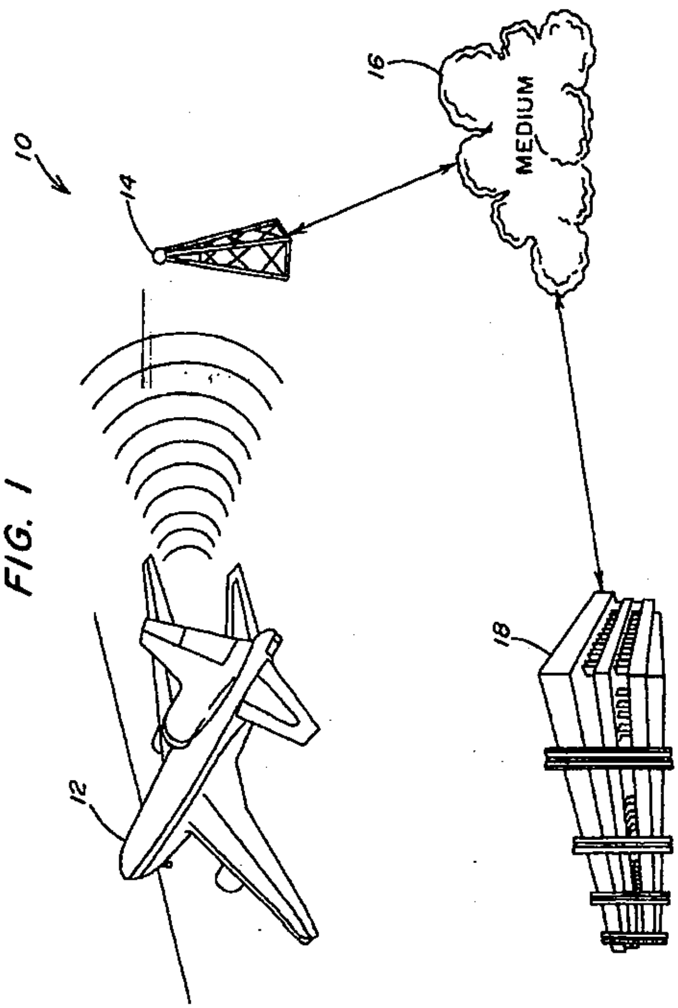

FIG. 1

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FIG. 2

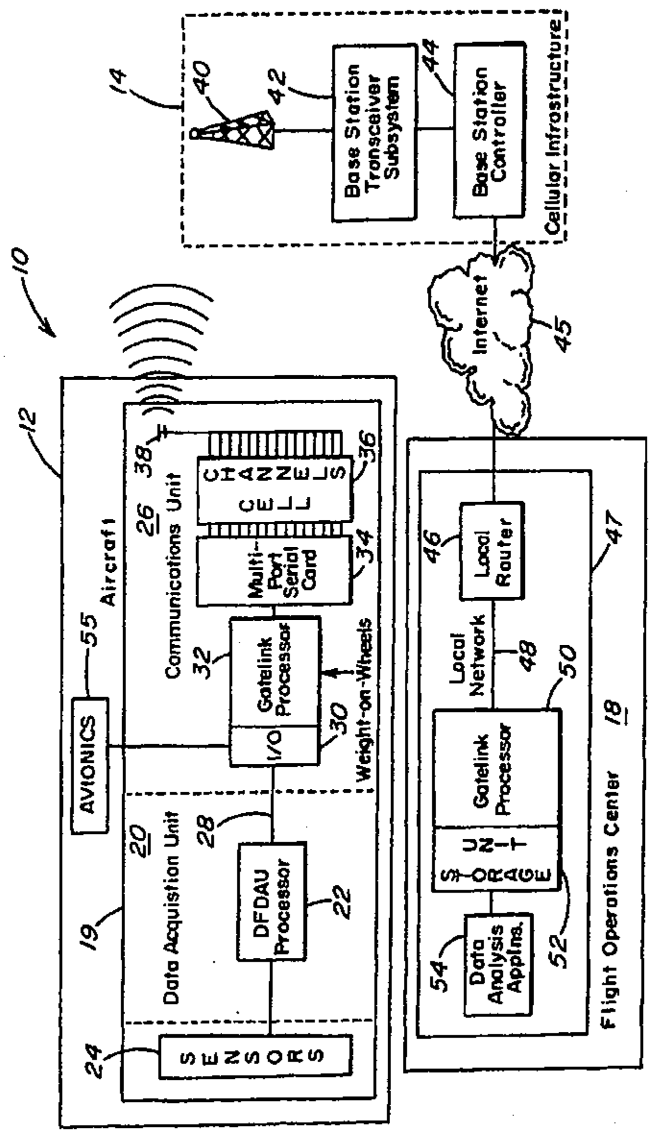

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FIG. 3

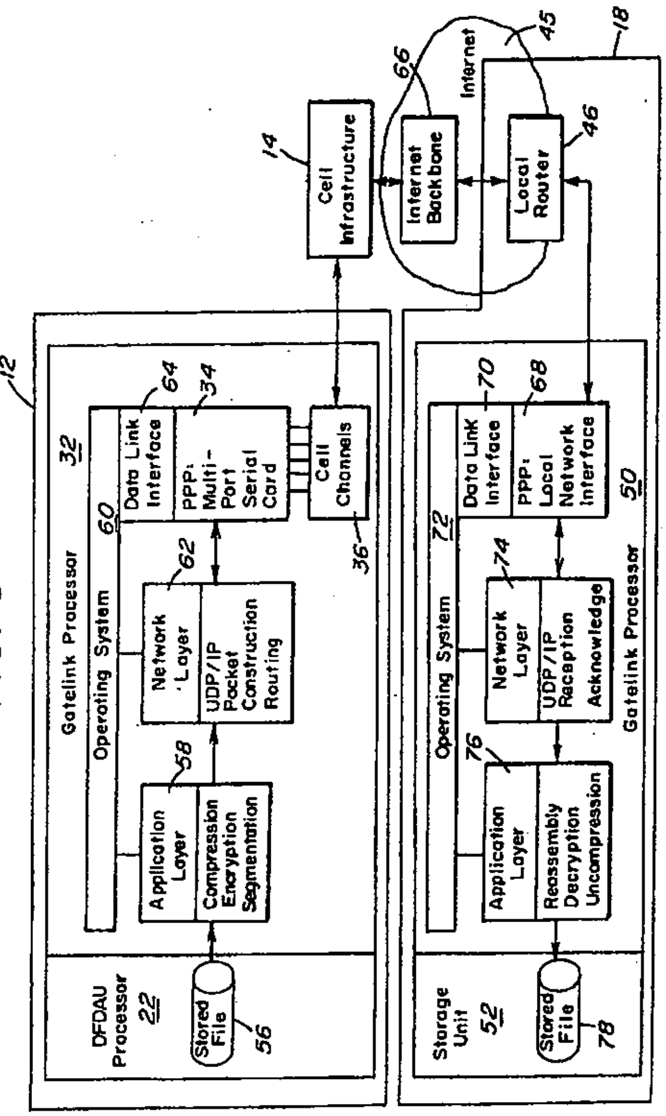

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FIG. 4

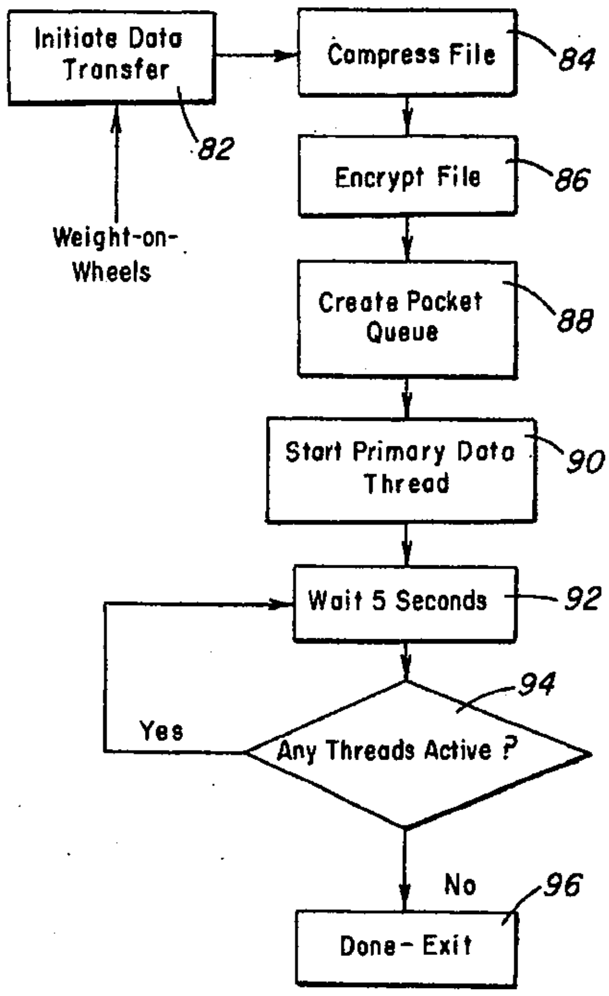
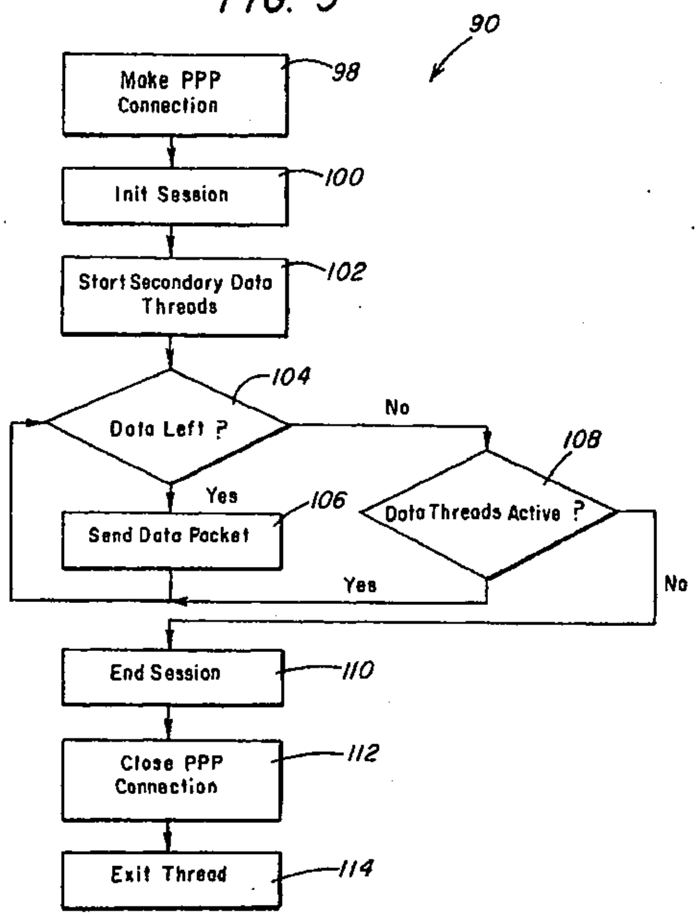

Initiate Data Transfer
82
Weight-on-Wheels
Compress File
84
Encrypt File
86
Create Packet Queue
88
Start Primary Data Thread
90
Wait 5 Seconds
92
94
Any Threads Active ?
Yes
No
96
Done - Exit

FIG. 5



90
Make PPP Connection
98
Init Session
100
Start Secondary Data Threads
102
Data Left ?
104
No
Yes
Send Data Packet
106
Data Threads Active ?
108
Yes
No
End Session
110
Close PPP Connection
112
Exit Thread
114

FIG. 6

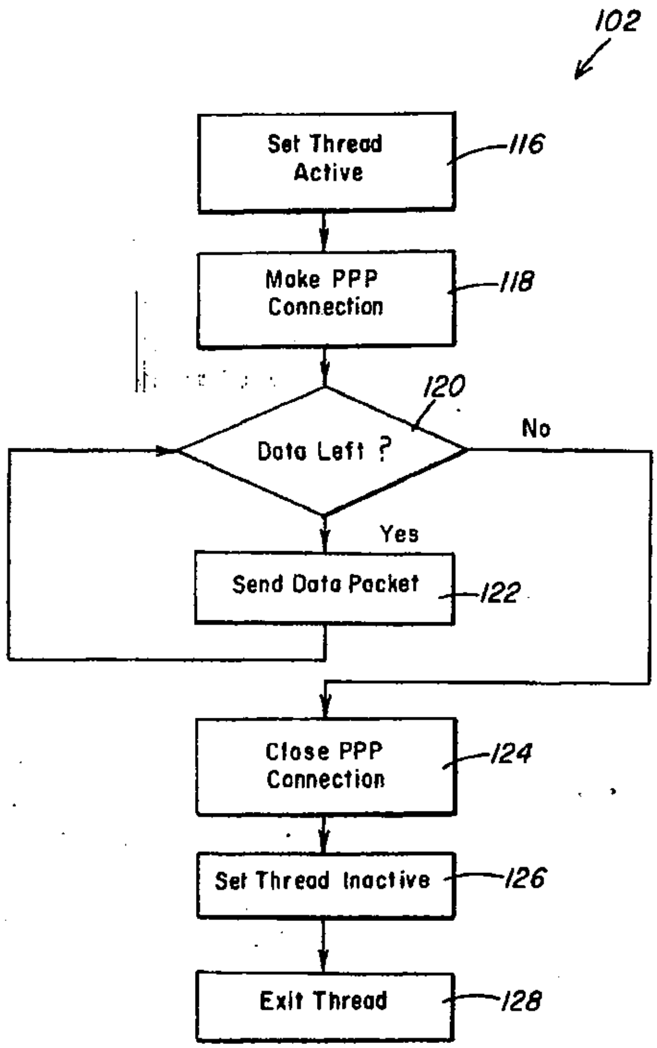
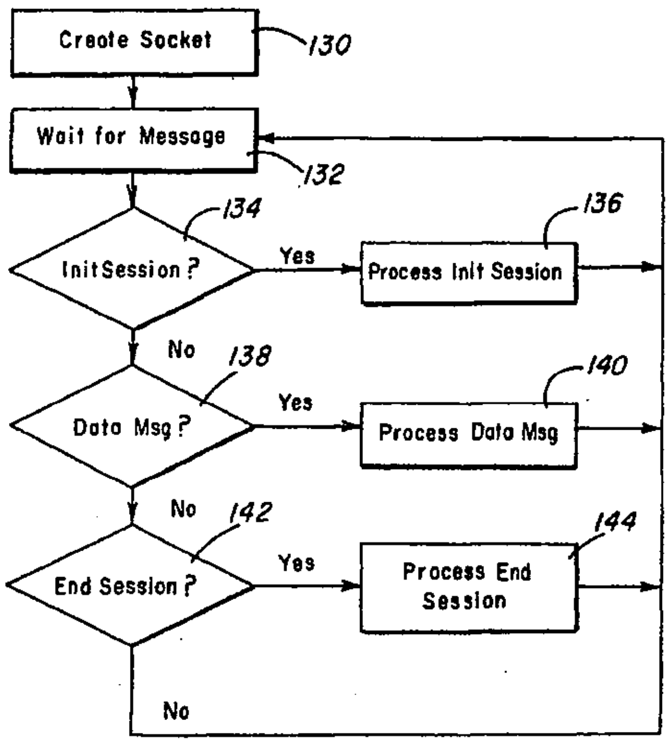

102
Set Thread Active
116
Make PPP Connection
118
120
Data Left ?
No
Yes
Send Data Packet
122
Close PPP Connection
124
Set Thread Inactive
126
Exit Thread
128

FIG. 7



Create Socket
130
Wait for Message
132
134
Init Session ?
Yes
Process Init Session
136
No
138
Data Msg ?
Yes
Process Data Msg
140
No
142
End Session ?
Yes
Process End Session
144
No

FIG. 8

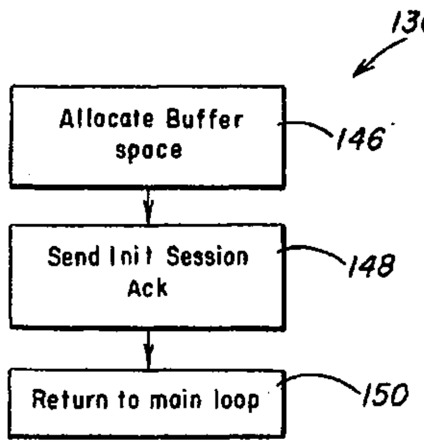
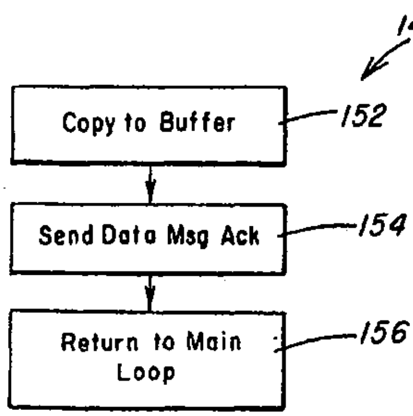


FIG. 9



4/27/05, EAST Version: 2.0.1.4

FIG. 10

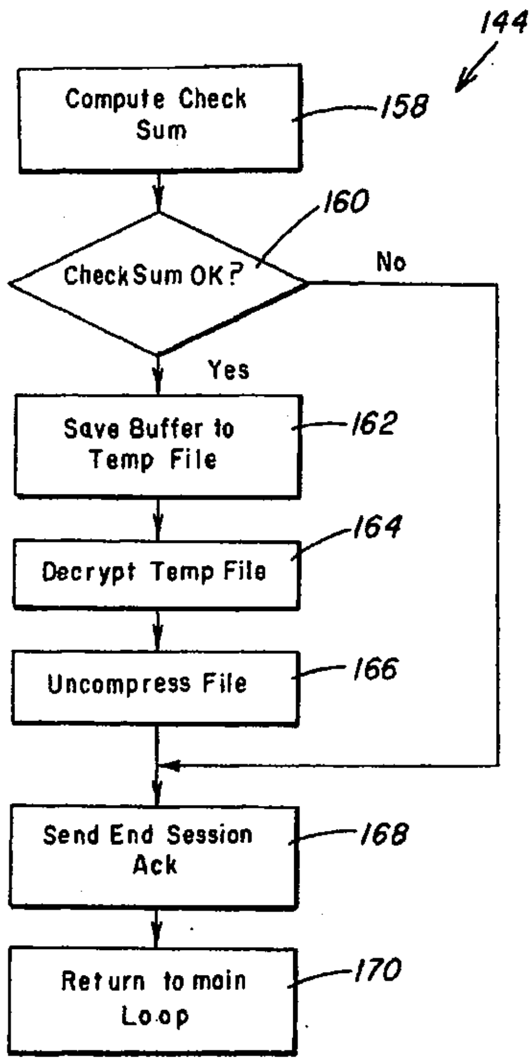
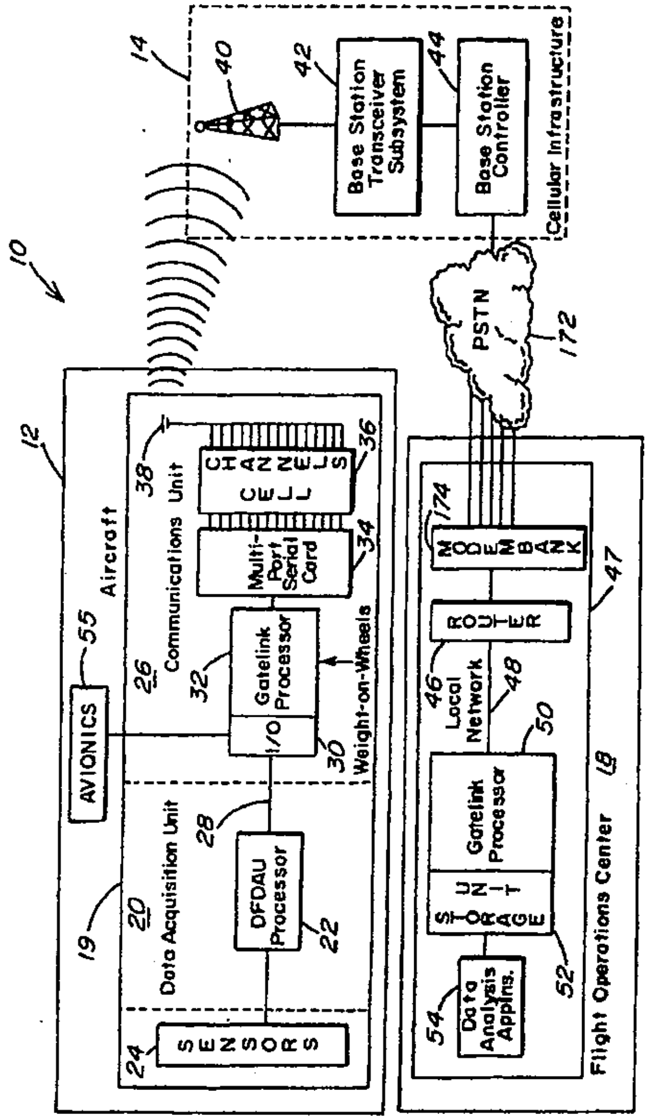

144
Compute Check Sum
158
160
Check Sum OK?
No
Yes
Save Buffer to Temp File
162
Decrypt Temp File
164
Uncompress File
166
Send End Session Ack
168
Return to main Loop
170

FIG. 11



4/27/05, EAST Version: 2.0.1.4

AIRCRAFT FLIGHT DATA ACQUISITION AND TRANSMISSION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

(Not Applicable)

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH

(Not Applicable)

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is directed generally to an aircraft flight data acquisition and transmission system and, more particularly, to an on-board cellular data transmission system.

2. Description of the Background

It is common for aircraft to generate records of data relating to flight and performance parameters for each flight of the aircraft. The data typically relate to parameters such as air speed, altitude, vertical acceleration, heading, time, etc. The data are utilized in the event of an accident or a near-accident and to assist in maintenance of the aircraft by detecting faulty components or gradual deterioration of a system or component, to assist in reviewing crew performance, and to assist in logistical planning activities such as scheduling and routing.

Aircraft data are typically gathered by a digital flight data acquisition unit (DFDAU). The DFDAU typically stores the data on magnetic or magnetic-optical media. When the aircraft lands, ground personnel board the aircraft, remove the media, and mail the media to a flight operations center (FOC). The manual removal and posting of the data adds a significant labor cost, yields less than desirable data delivery reliability, and results in a significant time delay before the data are useful for analysis.

It is known to use radio frequency (RF) transmissions to transmit data relating to an aircraft. Such teachings, however, require substantial investments to construct the RF transmission systems required for such a system to work. Furthermore, it is very expensive to create redundancy in such a system.

It is also known to transmit data relating to an aircraft via a telephone system located in a terminal. Such a system, however, requires that the aircraft be docked at the gate before transmission begins, thereby resulting in a substantial delay in the transmission. Furthermore, such a system requires an added step of transmitting the data from the aircraft to the terminal telephone system, increasing the cost of installing, operating, and maintaining such a system.

Thus, there is a need for an aircraft data transmission system that automatically transfers flight data from an aircraft to a flight operations center with little or no human involvement and which relies on a reliable wireless delivery system.

SUMMARY OF THE INVENTION

The present invention is directed to an aircraft data transmission system used with an aircraft having a data acquisition unit. The system includes a communications unit located in the aircraft and in communication with the data acquisition unit. The system also includes a cellular infrastructure in communication with the data communications unit after the aircraft has landed. The system further includes a data reception unit in communication with the cellular infrastructure.

The present invention represents a substantial advance over prior aircraft data acquisition and transmission systems. For example, the present invention has the advantage that it requires little expense to implement because it uses well-known technology and the cellular infrastructure which is already in place. The present invention also has the advantage that it can transmit data over multiple parallel channels to achieve the necessary transmission bandwidth and achieve a low data transmission time. The present invention has the further advantage that it does not require a dedicated data link between the aircraft and the flight operations center and/or an airport terminal.

BRIEF DESCRIPTION OF THE DRAWING

For the present invention to be clearly understood and readily practiced, the present invention will be described in conjunction with the following figures, wherein:

FIG. 1 illustrates an aircraft data acquisition and transmission system;

FIG. 2 is a block diagram illustrating a more detailed embodiment of the system illustrated in FIG. 1;

FIG. 3 is a block diagram illustrating data flow through the system illustrated in FIG. 2;

FIG. 4 is a flowchart illustrating a method carried out by the gatelink processor in the aircraft;

FIG. 5 is a flowchart illustrating a method of performing the start primary data thread step of FIG. 4;

FIG. 6 is a flowchart illustrating a method of performing the start secondary data threads step of FIG. 5;

FIG. 7 is a flowchart illustrating a method of operating the gatelink processor in the flight operations center;

FIG. 8 is a flowchart illustrating a method of performing the initialize session process step of FIG. 7;

FIG. 9 is a flowchart illustrating a method of performing the data message process step of FIG. 7;

FIG. 10 is a flowchart illustrating a method of performing the end session process step of FIG. 7; and

FIG. 11 is a block diagram illustrating another embodiment of the system illustrated in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

It is to be understood that the figures and descriptions of the present invention have been simplified to illustrate elements that are relevant for a clear understanding of the present invention, while eliminating, for purposes of clarity, other elements found in a typical communications system. It can be recognized that other elements are desirable and/or required to implement a device incorporating the present invention. For example, the details of the cellular communications infrastructure, the Internet, and the public-switched telephone network are not disclosed. However, because such elements are well known in the art, and because they do not facilitate a better understanding of the present invention, a discussion of such elements is not provided herein.

FIG. 1 illustrates an aircraft data acquisition and transmission system 10. An aircraft 12, which has stored flight data, is illustrated after landing. The aircraft 12 transmits flight data as cellular communications signals to a cellular infrastructure 14. The cellular infrastructure 14 acts as a

communications channel to the communications medium 16. A flight operations center 18 is connected to the medium 16 by any conventional connectivity medium such as, for example, a leased line. Once the cellular connections are made via the medium 16 data can flow bidirectionally from or to the aircraft.

FIG. 2 is a block diagram illustrating a more detailed embodiment of the system 10 illustrated in FIG. 1. The aircraft 12 includes a data system 19 having a data acquisition unit 20. The data acquisition unit 20 includes a digital flight data acquisition unit (DFDAU) processor 22, which includes a storage media for storing flight data in a digital format. The DFDAU processor 22 receives signals from sensors 24 which sense parameters such as air speed, altitude, vertical acceleration, heading, time, etc. The flight data are transferred to a communications unit 26 via a bus 28. The bus 28 is connected to an I/O interface 30 in the communications unit 26. The I/O interface 30 can be a standard bus interface such as, for example, an ARINC 429 bus interface.

The I/O interface 30 is connected to a gatelink processor 32. The processor 32 can be a general purpose processor such as a personal computer, a microprocessor such as an Intel Pentium® processor, or a special purpose processor such as an application specific integrated circuit (ASIC) designed to operate in the system 10. The processor 32 is responsive to a weight-on-wheels signal, which acts as an interrupt signal to signal the processor 32 to initiate transmission or reception of the data when the aircraft 12 has landed. Upon receipt of the weight-on-wheels signal from the landing gear of the aircraft 12, the processor 32 prepares the flight data for transmission and transmits the data to a multi-port serial card 34. Each I/O port of the card 34 is attached to a cell channel which can open, sustain, and close a physical, over-the-air channel to the cellular infrastructure 14. The cell channels 36 can transmit simultaneously and can thus transmit data in parallel. Each cell channel 36 is connected to an antenna matching network and a post amplifier (not shown). An antenna 38 is installed in the aircraft 12 so as to optimize free space radiation to the cellular infrastructure 14.

The data are transmitted over a cellular airlink using the physical layer modulation of the cellular infrastructure 14. The cellular infrastructure 14 includes an antenna 40, which is within free-space radiating range of the aircraft 12. The antenna 40 is connected to a base station transceiver subsystem 42. The subsystem 42 is connected to a base station controller 44 which has a direct connection via a router (not shown) to the Internet 45. The flight data are transmitted via the Internet 45 to the flight operations center 18.

A local router 46 in a data reception unit 47 of the flight operations center 18 is connected to the Internet 45, such as via a connection to the backbone of the Internet 45. The router 46 connects a local area network 48 to the Internet 45. The local area network can be of any type of network such as, for example, a token ring network, an ATM network, or an Ethernet network. A gatelink processor 50 is connected to the network 48 and receives the flight data for storage in an attached storage unit 52. The storage unit 52 can be any type of unit capable of storing data such as, for example, a disk array or a tape drive. The storage unit 52 makes the flight data available to data analysis applications 54 which can analyze and/or report the flight data to a user.

Data transfer can also occur from the flight operations center 18 to the aircraft 12. The data are transmitted via the Internet 45 and the cellular infrastructure 14 and received by the antenna 38. The serial card 34 receives the data from the cell channels 36 and the processor 32 outputs the data, via the I/O interface 30, to avionics 55.

FIG. 3 is a block diagram illustrating data flow through the system 10 illustrated in FIG. 2. The flight data is stored in the DFDAU processor 22 as a stored file 56. An application layer 58 of an operating system 60 of the gatelink processor 32 compresses, encrypts, and segments the data. The operating system 60 can be any type of operating system suitable such as, for example, UNIX. A typical stored file may be compressed from approximately 40 Mbytes to approximately 4 Mbytes. Compression may be done by any compression method such as, for example, the method embodied in the PKZIP® compression utility, manufactured by PKWARE, Inc. Encryption can be accomplished using any suitable asymmetric (public key) or symmetric encryption method such as, for example, the method embodied in Data Encryption Software (DES), manufactured by American Software Engineering or the methods in the RC2, RC4, or RC5 encryption software manufactured by RSA Data Security, Inc. During segmentation individual datagrams of, for example, 1024 bytes are formed and indexed for subsequent reassembly.

The operating system 60 passes the datagrams to a network layer 62 which constructs UDP/IP packets from the datagrams by adding message headers to the datagrams. The network layer 62 then routes the packets to one of up to 16 peer-to-peer protocol (PPP) threads running within the operating system 60 at a data link layer interface 64. The PPP threads convey the packets to the multi-port serial card 34 for transmission to the backbone 66 of the Internet 45 via the cell channels 36 to the cellular infrastructure 14. The packets are received from the Internet 45 by the local router 46 in the flight operations center 18. The network layer 62 receives acknowledgments of received packets from the gatelink processor 50 in the flight operations center 18. The network layer 62 also re-queues packets that are dropped before reaching the gatelink processor 50.

The local router 46 in the flight operations center 18 receives the packets and routes them to the gatelink processor 50. A local network interface 68 receives the packets and a data link layer interface 70 of an operating system 72 passes the packets to a network layer 74 of the operating system 72. The operating system 72 can be any type of suitable operating system such as, for example, UNIX. The network layer 74 sends acknowledgments of successful packet deliveries to the gatelink processor 32. The network layer 74 also removes the UDP/IP headers and passes the datagrams to an application layer 76. The application layer 76 reassembles, decrypts, and uncompresses the datagrams to restore the flight data to its original form. The application layer then passes the data to a stored file 78 in the storage unit 52. The functions performed by the aircraft 12 and the flight operations center 18 are similarly interchangeable when data is transferred from the flight operations center 18 to the aircraft 12.

FIG. 4 is a flowchart illustrating a method carried out by the gatelink processor 32 in the aircraft. At step 82, the gatelink processor 32 receives a weight-on-wheels interrupt which signals that the aircraft has landed, and the data transfer is initiated. The application layer 58 compresses the flight data at step 84 and encrypts the data at step 86. At step 88, the data is segmented into datagrams and UDP/IP packets are constructed. The packets are then placed in a packet queue. The packets are then ready for transmission as a fixed number of threads, corresponding to the number of cell channels 36. At step 90, the primary data thread is

started to make the initial call and open the communications channel to the flight operations center 18. A wait state at step 92 is invoked for a predetermined period of time (5 sec.) and at step 94, the processor 32 determines if any threads are active, i.e. if there are any packets that haven't been transmitted or have been transmitted and dropped. If there are no packets remaining, the method is completed at step 96. If there are packets remaining, the method enters the wait state at step 92 and subsequently determines if any threads are active at step 94.

FIG. 5 is a flowchart illustrating a method of performing the start primary data thread step 90 of FIG. 4. At step 98, the point-to-point protocol (PPP) connection is initiated for the primary data thread through one of the cell channels 36 and the gatelink session is initiated at step 100. The secondary data thread transmissions are started at step 102. At step 104, it is determined if any packets are left in the primary data thread to be transmitted. If so, the next packet in the primary data thread is transmitted at step 106. If no packets are left to transmit in the primary data thread as determined at step 104, it is determined if any of the secondary data threads are active at step 108. If so, the process returns to step 104 and repeats step 108 until no threads are active. If no threads are active, the gatelink session is ended at step 110 and the PPP connection for the primary data thread is closed at step 112. At step 114, the primary data thread step 90 is completed.

FIG. 6 is a flowchart illustrating a method of performing the start secondary data threads step 102 of FIG. 5. The method is carried out in parallel for each secondary data thread. At step 116, the thread is set to active so that the processor 32 can determine if any threads are active at step 108 of FIG. 5. The PPP connection for the secondary data thread being transmitted is initiated at step 118. At step 120, it is determined if any packets remain in the data thread. If so, the packet is transmitted at step 122. If no packets remain in the data thread, the PPP connection is closed at step 124 and the thread is set to inactive at step 126. The method is completed at step 128.

FIG. 7 is a flowchart illustrating a method of operating the gatelink processor 50 in the flight operations center 18. At step 130, a socket is opened to allow the operating system 72 in the processor 50 to receive and transport messages across the Internet 45. At step 132, the processor 50 waits for a message from the Internet 16. When a message is received, the processor 50 determines if the message is a session initialization message at step 134. If the message is a session initialization message, the processor 50 executes the session initialization process at step 136. If the message is not a session initialization message at step 134, the processor 50 determines if the message is a data message at step 138. If the message is a data message, the processor 50 executes the data message process at step 140. If the message is not a data message, the processor 50 determines if the message is an end session message at step 142. If the message is an end session message, the processor 50 executes the end session process at step 144 and then returns to step 132 to wait for additional messages..

FIG. 8 is a flowchart illustrating a method of performing the initialize session process step 136 of FIG. 7. The processor 50 allocates buffer space for subsequent data reception at step 146. The processor 50 then sends a session initialized data acknowledgment to the processor 32 at step 148. At step 150, the flow returns to step 132 of FIG. 7.

FIG. 9 is a flowchart illustrating a method of performing the data message process step 140 of FIG. 7. At step 152, the received data message is copied to a buffer and an acknowledgment of the data received is sent at step 154. At step 156, the flow returns to step 132 of FIG. 7.

FIG. 10 is a flowchart illustrating the steps included in the end session process step 144 of FIG. 7. At step 158, the checksum is computed for the received data to check the integrity of the data. The checksum is checked at step 160 and, if it is correct, the processor 50 saves the buffer to a temporary file at step 162. The processor 50 then decrypts the file at step 164 and uncompresses the file at step 166. The processor 50 sends an end session acknowledge message to the processor 32 at step 168 and at step 170, the flow returns to step 132 of FIG. 7. If the checksum is not correct, the processor 50 sends an unsuccessful end session message, which notifies the processor 32 to resend the data.

FIG. 11 is a block diagram illustrating another embodiment of the system 10 illustrated in FIG. 1. The operation of the system 10 of FIG. 11 is similar to that described in conjunction with the system 10 of FIG. 2. However, the flight data is transmitted from the cellular infrastructure 14 to the flight operations center 18 via the public-switched telephone network 172. A modem bank 174 receives the data via the PSTN 172. The data is then routed by the router 46 to the processor 50 via the network 48. The modem bank 174 can have a modem dedicated to receive data transmitted by one of the cell channels 36.

While the present invention has been described in conjunction with preferred embodiments thereof, many modifications and variations will be apparent to those of ordinary skill in the art. For example, although the system has been described hereinabove as transferring data from the aircraft, the system can also be used to transfer data to the aircraft with no modifications in the system. Also, the system may be used to transmit data while the aircraft is in flight. Furthermore, the system may be used without encryption and without data compression prior to sending data. The foregoing description and the following claims are intended to cover all such modifications and variations.

What is claimed is:

1. An aircraft data transmission system, the aircraft having a data acquisition unit, comprising:

a communications unit located in the aircraft and in communication with the data acquisition unit;

a cellular infrastructure in communication with said communications unit after the aircraft has landed, wherein the communication is initiated automatically upon landing of the aircraft; and

a data reception unit in communication with said cellular infrastructure.

2. The system of claim 1 wherein said data reception unit is in communication with said cellular infrastructure via the Internet.

3. The system of claim 1 wherein said data reception unit is in communication with said cellular infrastructure via the public switch telephone network.

4. The system of claim 1 wherein said communications unit has at least one modem in communication with said cellular infrastructure and said data reception unit has at least one modem in communication with said cellular infrastructure.

5. The system of claim 1 wherein said communications unit includes:

a processor;

a serial card in communication with said processor;

at least one cell channel in communication with said serial card; and

at least one antenna in communication with said cell channel.

6. The system of claim 1 wherein said cellular infrastructure includes:

an antenna;

a transceiver subsystem in communication with said antenna; and

a controller in communication with said transceiver subsystem.

7. The system of claim 1 wherein said data reception unit includes:

a router; and

a processor in communication with said router, said processor having a storage unit.

8. A data system for an aircraft, comprising:

a digital flight data acquisition unit in communication with at least one sensor;

a processor in communication with said digital flight data acquisition unit;

a serial card in communication with said processor; and

a plurality of cell channels in communication with said serial card, said cell channels for transmitting data via a cellular infrastructure after the aircraft has landed, wherein the communication between the cell channels and the serial card is initiated automatically upon landing of the aircraft.

9. The system of claim 8 further comprising an antenna in communication with said cell channels.

10. The system of claim 8 wherein said processor includes a personal computer.

11. The system of claim 8 wherein said processor includes an ASIC.

12. The system of claim 8 wherein said processor includes a microprocessor.

13. The system of claim 8 wherein said processor has an I/O interface in communication with said digital flight data acquisition unit.

14. An aircraft, comprising:

a digital flight data acquisition unit in communication with at least one sensor; and

a communications unit in communication with said digital flight data acquisition unit, said communications unit including:

a processor in communication with said digital flight data acquisition unit;

a serial card in communication with said processor; and

a plurality of cell channels in communication with said serial card, said cell channels for transmitting data via a cellular infrastructure after the aircraft has landed, wherein the communication between the cell channels and the serial card is initiated automatically upon landing of the aircraft.

15. An aircraft data transmission system, the aircraft having a data acquisition unit, comprising:

means for transmitting data from the data acquisition unit via a cellular infrastructure after the aircraft has landed, wherein transmission of the data is initiated automatically upon landing of the aircraft; and

means for receiving said data from said cellular infrastructure.

16. The system of claim 15 wherein said means for transmitting data includes a processor.

17. The system of claim 15 wherein said means for receiving data includes a processor.

18. A method of transmitting aircraft flight data from an aircraft, comprising:

receiving flight data from a data acquisition unit;

transmitting said flight data via a cellular communications infrastructure after the aircraft has landed, wherein the cellular communications infrastructure is accessed automatically upon landing of the aircraft; and

receiving said transmitted flight data.

19. A computer-implemented method of transmitting aircraft flight data from an aircraft, comprising:

receiving flight data from a digital flight data acquisition unit;

processing said flight data to prepare said data for transmission; and

transmitting said processed data via a cellular infrastructure after the aircraft has landed, wherein the cellular infrastructure is accessed automatically upon landing of the aircraft.

20. The method of claim 19 further comprising receiving said transmitted data at a flight operations center.

21. The method of claim 20 further comprising receiving said transmitted data and transmitting said received data via the Internet before receiving said transmitted data at a flight operations center.

22. The method of claim 20 further comprising receiving said transmitted data and transmitting said received data via the public-switched telephone network before receiving said transmitted data at a flight operations center.

23. The method of claim 19 wherein processing said flight data includes:

compressing said flight data;

encrypting said flight data;

segmenting said flight data; and

constructing packets of data from said segmented flight data.

24. The method of claim 19 wherein receiving said transmitted data includes:

acknowledging receipt of said transmitted data;

reassembling said received data;

decrypting said reassembled data;

uncompressing said decrypted data; and

storing said uncompressed data.

25. A computer-implemented method of transmitting aircraft flight data from an aircraft, comprising:

receiving flight data from a digital flight data acquisition unit;

processing said flight data to prepare said data for transmission; and

transmitting said processed data via a cellular infrastructure after the aircraft has landed, wherein processing said flight data includes:

receiving a weight-on-wheels signal;

initiating a data transfer;

compressing said flight data;

encrypting said compressed data;

creating a packet queue;

starting a primary data thread;

waiting a predetermined period of time;

determining if any threads are active;

repeating, when threads are active, the steps of waiting a predetermined period of time and determining if any threads are active; and

exiting processing said flight data when no threads are active.

26. The method of claim 25 wherein starting a primary data thread includes:

initiating a PPP connection;

initiating a transfer session;

starting at least one secondary data thread;

determining if data remains in the primary data thread;

sending said data when data remains in the primary data thread;

determining if data threads are active when no data remains in the primary data thread;

repeating, when said threads are active, the step of determining if data remains in the primary data thread;

ending said session when no threads are active;

closing said PPP connection; and

exiting starting a primary data thread.

27. The method of claim 26 wherein starting at least one secondary data thread includes:

(a) setting the secondary data thread to active;

(b) initiating a PPP connection;

(c) determining if data remains in the secondary data thread;

(d) sending a data packet when data remains;

(e) repeating step c when data remains;

(f) closing said PPP connection when no data remains;

(g) setting the secondary data thread to inactive;

(h) exiting starting at least one secondary data thread; and

(i) repeating steps a through h for each secondary data thread.

28. The method of claim 27 wherein repeating steps a through h includes repeating steps a through h in parallel for each said secondary data thread.

29. A computer-implemented method of transmitting aircraft flight data from an aircraft, comprising:

receiving flight data from a digital flight data acquisition unit;

processing said flight data to prepare said data for transmission; and

transmitting said processed data via a cellular infrastructure after the aircraft has landed; and

receiving said transmitted data at a flight operations center, wherein receiving said transmitted data includes:

creating a socket;

receiving a message;

determining if said message is an initialization message;

initiating a session when said message is an initialization message;

determining if said message is a data message when said message is not an initialization message;

processing said message when said message is a data message;

determining if said message is an end session when said message is not a data message;

processing said message when said message is an end session; and

repeating, when said message is not an end session message, the step of receiving a message.

30. The method of claim 29 wherein initializing a session includes:

allocating buffer space;

sending an initiation session acknowledgment; and

returning to receiving a message.

31. The method of claim 29 wherein processing said message when said message is a data message includes:

copying said message to a buffer;

sending a data message acknowledgment; and

returning to receiving a message.

32. The method of claim 29 wherein processing said message when said message is not an end session includes:

computing a checksum;

determining if said checksum is valid;

saving a buffer to a temporary file;

decrypting said temporary file;

uncompressing said temporary file;

sending an end session acknowledgment; and

returning to receiving a message.

33. A computer readable medium having stored thereon instructions which when executed by a processor, cause the processor to perform the steps of:

receiving flight data from a digital flight data acquisition unit in an aircraft;

processing said flight data to prepare said data for transmission; and

transmitting said processed data via a cellular infrastructure when said aircraft has landed, wherein the cellular infrastructure is accessed automatically upon landing of the aircraft.

* * * * *

Patent Assignment Abstract of Title

#2

Total Assignments: 2

Application #: 09126156 **Filing Dt:** 07/30/1998 **Patent #:** 6181990 **Issue Dt:** 01/30/2001

PCT #: NONE **Publication #:** NONE **Pub Dt:**

Inventors: JOHN FRANCIS GRABOWSKY, DAVID RAY STEVENS

Title: AIRCRAFT FLIGHT DATA ACQUISTION AND TRANSMISSION SYSTEM

Assignment: 1

Reel/Frame:	Received:	Recorded:	Mailed:	Pages:
009353/0790	08/05/1998	07/30/1998	10/21/1998	4

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

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Assignment: 2

Reel/Frame:	Received:	Recorded:	Mailed:	Pages:
013146/0358	08/07/2002	08/01/2002	10/04/2002	24

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

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90/006,742	08/12/2003	6181990

#3

CONFIRMATION NO. 1151

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Orlando, FL 32802

Date Mailed: 09/12/2003

NOTICE OF REEXAMINATION REQUEST FILING DATE

(Third Party Requester)

Requester is hereby notified that the filing date of the request for reexamination is 08/12/2003, the date the required fee of $2,520 was received.

A decision on the request for reexamination will be mailed within three months from the filing date of the request for reexamination. (See 37 CFR 1.515(a)).

A copy of the Notice is being sent to the person identified by the requester as the patent owner. Further patent owner correspondence will be the latest attorney or agent of record in the patent file. (See 37 CFR 1.33). Any paper filed should include a reference to the present request for reexamination (by Reexamination Control Number).

cc: Patent Owner

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REEXAM CONTROL NUMBER	FILING OR 371 (c) DATE	PATENT NUMBER
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#4

CONFIRMATION NO. 1151

REEXAM ASSIGNMENT NOTICE

Kirkpatrick & Lockhart LLP
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Date Mailed: 09/12/2003

NOTICE OF ASSIGNMENT OF REEXAMINATION REQUEST

The above-identified request for reexamination has been assigned to Art Unit 3661. All future correspondence to the proceeding should be identified by the control number listed above and directed to the assigned Art Unit.

A copy of this Notice is being sent to the latest attorney or agent of record in the patent file or to all owners of record. (See 37 CFR 1.33(c)). If the addressee is not, or does not represent, the current owner, he or she is required to forward all communications regarding this proceeding to the current owner(s). An attorney or agent receiving this communication who does not represent the current owner(s) may wish to seek to withdraw pursuant to 37 CFR 1.36 in order to avoid receiving future communications. If the address of the current owner(s) is unknown, this communication should be returned within the request to withdraw pursuant to Section 1.36.

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